Teens, Social Media, and Suicide: Virtual No More

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Objectives

- Typical adolescent use of social media
- Developmental neuroscience and social media effects on teens?
- Social media (SM) and suicide risk
  - Cyber-victimization
  - Digital footprints of suicidal risk
  - Contagion
  - Sources of support and help
- Implications for further study and policy

A snapshot of adolescent SM use

- Frequency
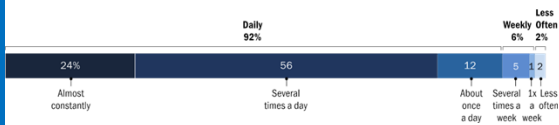- Type of platforms
- Sociodemographic correlates

Upward trend in social media use in past decade corresponds to increase in teen suicide
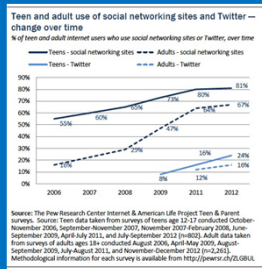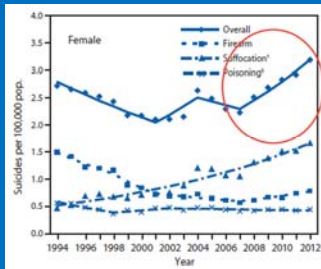
Internet Use Frequency by Adolescents

http://www.pewinternet.org/2015/04/09/teens-social-media-technology-2015/pi_2015-04-09_teensandtech_15-2/

Adolescents' use of SM

Teens' Phone, Computer & Console Access

% of all teens who have or have access to the following:

A desktop / laptop computer	87
A gaming console	81
A smartphone	73
A tablet computer	58
A basic cell phone	30

Source: Pew Research Center's Teens Relationships Survey, Sept. 25-Oct. 9, 2014 and Feb. 10-Mar. 16, 2015 (n=1,060 teens ages 13 to 17).

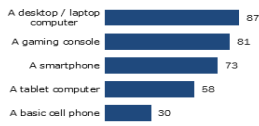PEW RESEARCH CENTER

Facebook, Instagram and Snapchat Top Social Media Platforms for Teens

% of all teens 13 to 17 who use ...

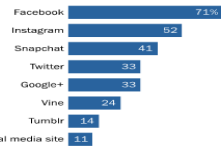|	
Facebook	71%
Instagram	52
Snapchat	41
Twitter	33
Google+	33
Vine	24
Tumblr	14
Different social media site	11

Source: Pew Research Center's Teens Relationships Survey, Sept. 25-Oct. 9, 2014 and Feb. 10-Mar. 16, 2015. (n=1,060 teens ages 13 to 17).

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SM Use by Household Income

Split in Social Media Used Most Often by Household Income

Among teens ages 13 to 17, the % of teens who use ____ most often, by household income

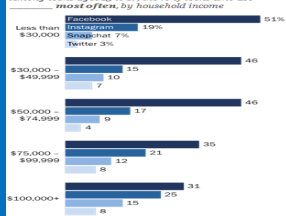|	
Less than $30,000 Facebook	51%
Instagram	19%
Snapchat	7%
Twitter	3%
$30,000 – $49,999	46
	15
	10
	7
$50,000 – $74,999	46
	17
	9
	4
$75,000 – $99,999	35
	21
	12
	8
$100,000+	31
	25
	15
	8

Source: Pew Research Center's Teens Relationship Survey, Sept. 25-Oct. 9, 2014 and Feb. 10-March 16, 2015. (n=1,060 teens ages 13 to 17).

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## Sociodemographic correlates of SM use (Pew Report, 2015)

- Girls more active on social media, boys on gaming
- African American youth more likely to have a smartphone (85%) vs. 71% for White and Hispanic youth
- Lower SES more likely to use Facebook; middle and upper SES, make greater use of Instagram (but Facebook still dominates)
- Lower SES youth have more consistent network of friends on all social media platforms

3

Social and affective neuroscience and effects of Social Media

- Reward and reputation
- Response to "popular" and to "risky" pictures
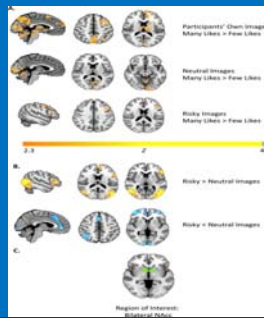- Peer rejection
- Influencing others

Neural responses to improved reputation (Meshi et al 2013)

- 31 healthy young adults
- Rated on "Facebook intensity score"
  - Time on Facebook
  - Need/desire to go on Facebook
  - Number of friends
- Monetary reward and "enhanced reputation" social reward tasks
- Activation in nucleus accumbens =reward response
- Greater activation to "enhanced reputation," greater Facebook intensity score.
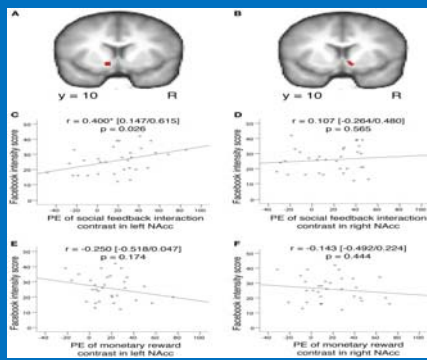
Neural responses to social media (Sherman et al. 2016)

- 34 adolescents
- Looked at 148 pictures
- Classified by number of likes, and whether risky or not.
- More likely to endorse pictures with more likes
- Show greater reward activation for risky images and for popular images
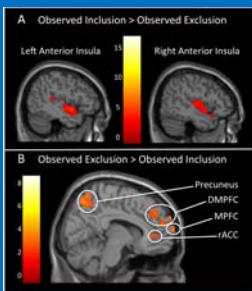- Show less activation of cognitive inhibitory network when viewing risky pictures

Neural response to peer acceptance and rejection (Masten et al. 2013)
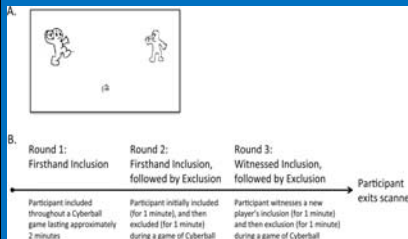
- Cyberball task (while in fMRI scanner)
  - R1: inclusion (throwing ball back and forth)
  - R2: inclusion followed by exclusion
 - R3: witness inclusion/exclusion of a peer

Masten et al., 2013

- After rejection, witnessing peer inclusion causes emotional pain similar to personal rejection
- Watching peer be excluded resulted in activation of regions known to associated with emotion regulation (DMPFC, MPFC, precuneus)—dampening response or could be empathizing
- Therefore, exposure to rejection can make it hard for that person be supportive of others' acceptance, and, when other peers are rejected, might either distance from peer rejection or more empathic to their plight
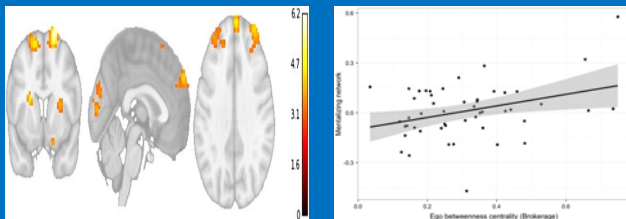
High vs. lower influence information brokers on Facebook (O'Donnell et al., 2017)

- 65 adolescents
- Gave researchers access to Facebook and used software to determine who were "high information brokers" using network analysis
- Task was to make a recommendation of gaming application
- Participants were given peer feedback relevant to their recommendations

O'Donnell et al. (2017): High vs. low information brokers
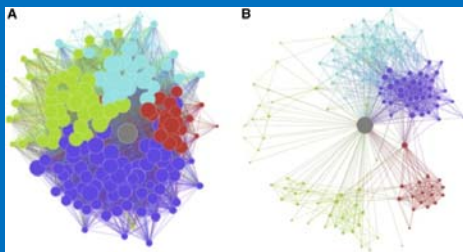
Greater activation in areas associated with "mentalizing" in those who are high information brokers (O'Donnell et al., 2017)

High vs. lower information brokers

- High information brokers showed a greater tendency to activate "mentalizing" network (DMPFC, MPFC, posterior cingulate, etc.) when given peer feedback divergent to their own initial opinion
- Influential information brokers show greater activation of brain regions associated with considering the viewpoints of others when given peer opinions that differ from their own

Tentative conclusions from these studies

- Social media can be rewarding and shape reward responses
- Risky and popular stimuli elicit responses that could lead to risky behavior
- Peer rejection could make peers less sensitive to other peers' exclusion and more upset about other peers' acceptance
- Those who are more influential on Facebook could be due to a greater tendency to consider the responses of others

Impact of Internet and Social Media Use on Suicide Risk

- Time and timing
- Direction of association
- Mechanisms
  - Sleep
  - Social comparison
  - Cyber-victimization

Longitudinal effects of internet use (Hokby et al., 2016)

- 2286 European youth who participated in prevention trial
- Assessed depression at baseline and 4 months later
- Gaming, gambling, targeted searches related to mental health
- Mediated by impact on sleep

gambling
gaming
porn
searches
School
Social
Total time

0   5   10   15   20

■ hrs/week
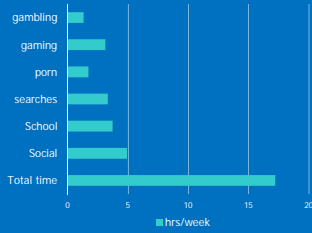
Time on SNSs and mental health (Sampasa-Kanyinga et al., 2015a)

- Survey of 753 Ontario students (in 2013) (cross-sectional)
- 25.2% using SNSs more than 2 hrs/day
- 54.3% < 2 hrs/ day
- 20.5% minimal or none
- Amount of use (especially 2+ hrs/ day related to distress, poor self-related well-being, and suicidal ideation

Internet effects on suicide

- Longitudinal studies suggest that internet use results in a decrease in mood rather than vice versa (van Eijnden et al, 2014; Landoll et al., 2015)
  – Social comparison
  – Cyberbullying (Underwood & Ehrenreich, 2017; Hamm et al., 2015; Bottino et al., 2015)
  – Decreased sleep

Technology-based social comparison, popularity, and depression (Nesi & Prinstein, 2015)
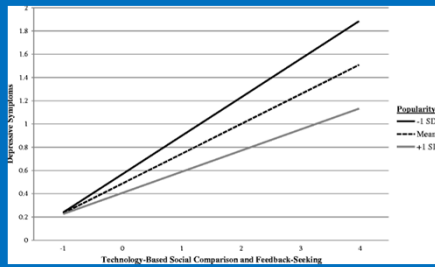

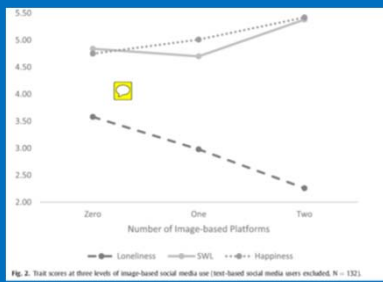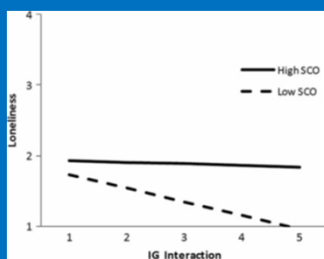## Image-based SNS, Loneliness and Happiness (Pittman & Reich, 2016)

Social Comparison Orientation, IG use, and Loneliness (Yang et al., 2016)

## Authenticity on Facebook (Grieve et al., 2017)

- Hexaco (60 item personality inventory)– self report and abstracted from Facebook posts
- Greater distance between self report and Facebook image, greater depression, lower social connection, greater anxiety.

SNS/Internet use, sleep, and depression

- Arousal from material viewed on SM
- Screen emission (suppression of darkness-related melatonin release)
- Computer/screen time in hour prior to bedtime related to sleep disruption and lower total sleep time (Orzech et al., 2016)
- Later Sleep-onset time
- Sleep disruption**
- Decreased sleep time, increased cellphone/email use associated with increased odds in being involved with bullying (OR's 1.2-1.5) (Tochigi et al., 2012)

Internet/SNS use and depression (Lemola, 2015)

- 362 teens
- Relationship of SNS use, sleep, and depression
- Sleep disturbance most important mediator
- Staying online and having phone available at bed time most predictive
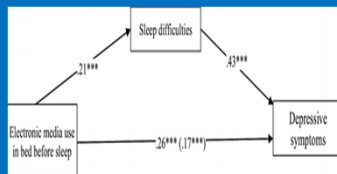
Cyber-victimization

- Frequency
- Profile of victims and victimizers
- Relationship to adverse outcomes
- Moderating factors

Review of cyberbullying (Baltino et al., 2015)

- Review 43 articles
- Prevalence: 20-40% experience at least once, 9% frequent victimization
- Methods: pictorial, verbal, exclusion
- Worst effects if: bullier is an adult, use pictures, has contact with victim off-line as well.
- 68.5% report adverse effects. Bulliers 1.5 increased odds of suicidal ideation, victims, 1.9.
- Van Geel et al. 2014: OR= 2.2 for ideation, 2.6 for attempts

Relationship between "unnatural" child deaths and prevalence of CV (Hong et al., 2016)
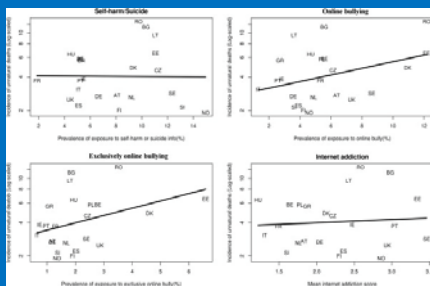
Cyber-victims and cyber-bullies: Two sides of the same coin?

- Cyber-victims
  - Somatic complaints
  - Not feeling safe/protected at school
  - High amount of SNS use
  - 3-4 fold increased risk of depression
- Cyber-bullies (often victims, too)
  - Headaches
  - Don't feel safe at school
  - ADHD and alcohol/drug use

## Cyberbullying and traditional victimization (Hemphill et al., 2015)

- 673 adolescents.
- Predictors of cyber-victimization were: previously having been bullied, low family attachment, high family conflict, low emotion regulation
- Family support and emotion regulation can play a role in helping the child to have resilience to being bullied
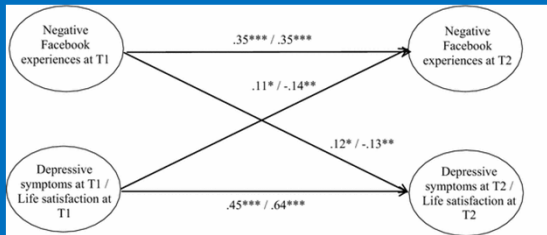
Parental monitoring and cybervictimization (Khurana et al, 2015)
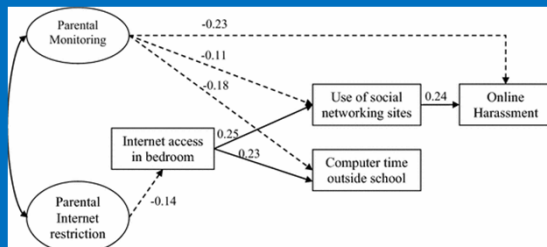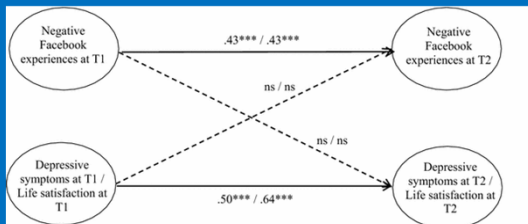
CH, Support, and Symptoms (Fridh et al., 2015—N=8544)
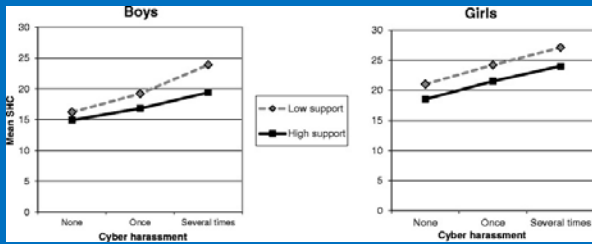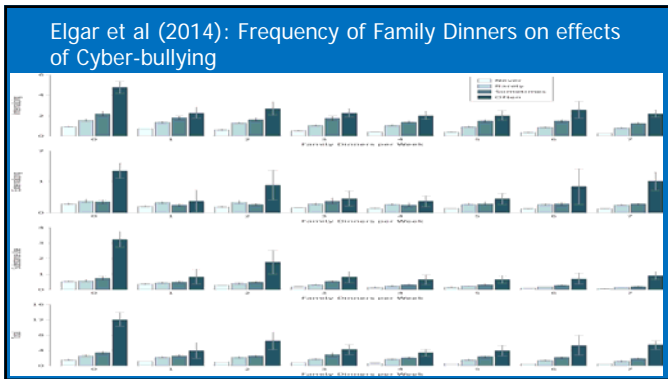

Frison et al., 2016: Negative Facebook experiences and Depression/Life satisfaction with **low** perceived peer support

Frison et al. (2016): Negative Facebook experiences and depression/life satisfaction with **high** perceived peer support.

Elgar et al (2014): Frequency of Family Dinners on effects of Cyber-bullying

Cyberbullying

- Family monitoring and peer support moderate the effects of cyberbullying (Hemphill et al., 2014; Khurana et al., 2015; Livingston & Smitth, 2014; Hebert et al., 2016; Frison et al., 2016)
- Cyberbullying mediates relationship between SM use and suicidal ideation (Sampasa-Kanyiga et al., 2014; Hong et al., 2016; van Geel et al., 2014)
- Cyberbullying associated with decreased sleep (Souranger et al, 2010; Wood & Scott, 2016; McIver et al., 2015).

Conclusions

- For youth who are being cybervictimized, consider de-activating accounts or blocking abusive interactions
- But kids will often generate a private account, therefore:
  - discussion about responsible and safe use of SM
  - deal with bullying in vivo at school
  - safety plan
 - parental monitoring of use
  - timing and sleep

Digital Footprint of Suicidal People on SM

- Posts and contagion
- Posts and national statistics
- Posts and individual digital "fingerprints"

Social Media and Suicide Contagion

- Because individuals can be affected by social media across a widely distributed geographic network, suicide clusters may occur in time, but not necessarily in space.
- Several studies show that an increase in suicides after a celebrity suicide is mediated by social media posts about the suicide (Ju et al., 2014; Arora et al.; Myung et al., 2015; Ueda et al., 2014; Sun et al., 2015; Yang et al., 2013)
- Great connectivity of suicidal "Tweeters"

Relationship between SM posts and suicide (Won et al., 2013)
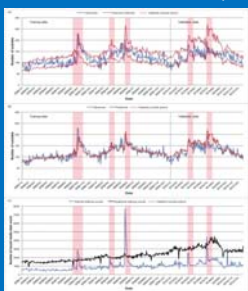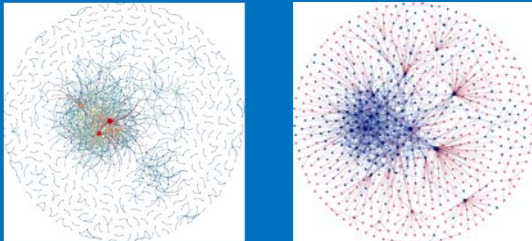

- 153,107,350 posts on 5,093,832 sites in ROK
- Dysphoria or suicide
- Prediction of suicide rate in next 3 days= 0.88 for training set, 0.79 for replication

Song et al., 2014: Google Searches and Suicide

- Examined Google searches related to suicide, stress, alcohol and correlation with national suicide rate in the ROK
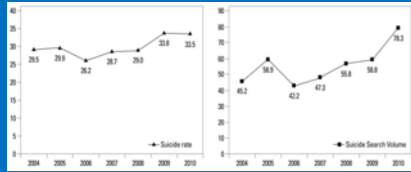
Suicidal Twitter Users Connectivity (Columbo et al., 2016)

Digital Fingerprints of Suicidal Persons

- Content on social media (Twitter, Tumblr) related to suicidal, depressive themes is correlated with clinical symptoms (Braithwaite et al., 2016; Passos et al., 2016; Sueki et al., 2015; O'Dea et al., 2017; Moreno et al., 2016)
- Content also is more self-referential, with themes of loneliness, self-loathing, rejection, poor body image
- Therefore, it is possible to identify individuals who are suicidal on the basis of their social media content (Guan et al., 2015; Cheng et al., 2015, 2017; Cavazos et al., 2017)

Cavazos-Rehg et al., 2017: Tumblr sites for depression

- Reviewed 17 depression-related Tumblr sites (3360 posts, about 82% of comments were related to depression
- Often reblogged (1.7 million posts)
- 15% self-loathing
- 15% loneliness or feeling a burden to others
- 15% self-harm
- 15% suicidal ideation or behavior

Sueki et al., 2015: Japan survey of Twitter users

- 220,848 participants
- 61.3% female, avg age=24.9 years
- Tweeting wanting to die or wanting to commit suicide associated with 2-fold increased risk for ideation, plan, attempt, and NSSI

The Secret Society of Self-harm (Moreno et al., 2016)

- Blithe#
- Self-harm
- Self-injury
- Ehtlib

#MySecretFamily
Repost if you battle with any of these and put the name in your profile

| Disorder	Girls	Boys
Anorexia	Ana	Rex
Bulimia	Mia	Bill
Paranoia	Perry	Pat
Anxiety	Annie	Max
ADD/ADHD	Addie	Andy
OCD	Olive	Owen
Borderline	Bella	Ben
Bipolar	Bri	Bob
Schizophrenia	Sophie	Skip
Insomnia	Izzy	Isaiah
EDNOS	Ellie	Ed
Selfharm	Cat	Sam
Depression	Deb	Dan
Suicidal	Sue	Dallas

Linguistic analysis of Weibo postings (Cheng et al., 2015)

- 974 participants
- Suicide probability (increased use of pronouns, fewer verbs, increased word count)
- Depression, increased use of 2nd person plural (they)
- Suicide communication (decreased communication about work, decreased use of 3rd person plural
- Overall classification wasn't so good but proof of concept

## Data mining of Korean adolescents' SM (Song et al., 2016)

- 2.35 billion postings from 1/1/11-12/31/12 on 163 websites
- 99,693 postings related to suicide
- Strongest path was academic pressure→ depression→ suicidality, but body image, bullying, concern about illness also played roles
- Recommended monitoring of SM for an intervention

Absolutistic words and suicide risk (al-Mosiawi & Johnstone, 2018)
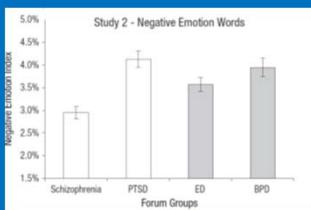
- **1** absolutely
- **2** all
- **3** always
- **4** complete
- **5** completely
- **6** constant
- **7** constantly
- **8** definitely
- **9** entire
- **10** ever
- **11** every
- **12** everyone
- **13** everything
- **14** full
- **15** must
- **16** never
- **17** nothing
- **18** totally
- **19** whole

Language analysis on disease-specific fora (Al-Mosaiwi & Johnstone, 2018)
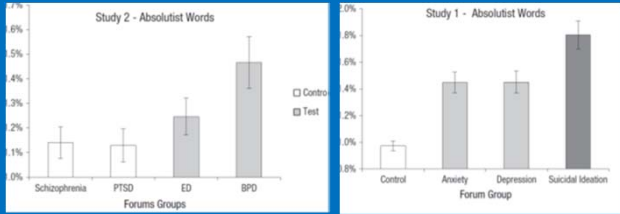
Positive effects of Social Media

- Discussion boards (Niederkrotenthaler et al., 2016; Ybarra et al. 2015)
- Suicide watch fora (Kavulara et al., 2016; Til & Niederkrotenthaler et al., 2016)
- Crisis/text (e.g., Berroguiguet et al., 2014; Predmore et al., 2017)
- On-line treatments of depression, suicidality, insomnia (Park & Conway, 2017; Harris et al., 2014; Coulson et al., 2016)
- Social support on line (Ybarra et al., 2015)

Dyson et al (2016): SNS for those engaging in self-harm

- Most were young adults (19-21)
- 69% female
- 19% acknowledged a history of depression
- Positives
  - Support
  - Advice about how to stop self-harming
  - Advice on obtaining treatment
- Negatives
  - Normalizing
  - Vivid images of self-harm
  - Concealment, encouragement, provocation

The Facebook Initiative

- Use of AI to identify words related to suicidal risk
- To present to those at risk options for help
- To make those options accessible via Facebook
- Analogous initiative prevention of on-line harassment–bubble=that comment might be considered harmful.

Offline Versus online Suicide-Related Help Seeking: Changing Domains, Changing Paradigms (Young (A) vs. Middle-aged (B) Adults
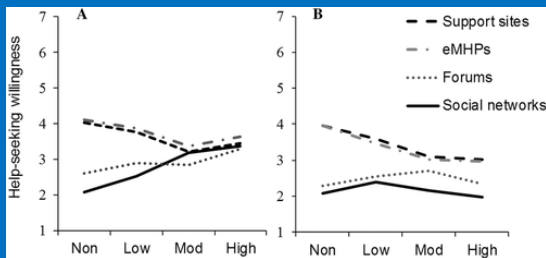
ML and NLP and Suicide

- ML and NLP can identify aggregations of risk factors that can predict suicide
- Can identify patterns of phrases associate with suicide risk
- Pair with pop—up warnings, links to support, provide safety plan or app to help diminish the risk of suicide

Conclusions

- There is a link between SM use and suicidal risk
  - Amount time
  - Impact on sleep
  - Cyber-bullying
  - Moderated by family and peer support
  - Type of language in posting
  - Contagion
- There is also evidence of supportive and protective functions from SM
  - Social support
  - Finding and getting help
  - Automated case finding and intervention

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Technology and Adolescent Mental Health

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Thank you for your attention!

- For copies of these slides, please email Joseph Park at parkj5@upmc.edu