Traditional media use and depression in the general population: evidence for a non-linear relationship

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Abstract

Depression is the most common metal disorder linked to media use. Theoretically, the relationship between depression and media use has been conceptualized as a linear function. However, depressive symptoms vary from dysphoric moods to severely depressed states with major social impairment, thus providing a strong alternative rationale for a non-linear relationship. This paper reports on findings from a representative telephone survey of the general German population ($N = 2002$) including both the respondents' motivation behind spending time using traditional media and a measure to screen for depression in the general population. The curve-fitting methodology revealed that the associations between depression and media use are described by a cubic growth function for newspapers, the radio, magazines, and books; associations with television use were positive, but more complex. The relationship between depression and media use should be modeled as a polynomial function for more accurate estimations in the future.

Depression casts its shadows over the human mind and negatively affects the mood and the activity levels of approximately 30 million people across Europe (Wittchen et al. 2011), and appears to be on the rise together with new media technologies (Lim et al. 2018). The main symptoms are depressed mood, a loss of interest in normal activities and relationships, oftentimes paired with fatigue, usually lasting two weeks, very likely to reoccur, and causing noticeable problems in daily life activities. Depression has an early onset, but is usually more prevalent among females and among adults aged 40–59 than among males and younger or older age groups (Lim et al. 2018; Pratt and Brody 2014).

Interestingly, media use has been associated with the development or onset of depression (Bickham et al. 2015; George et al. 2018; Lucas et al. 2011; Nimrod 2017; Primack et al. 2018; Primack et al. 2009; Shensa et al. 2017). Media use has also been implicitly conceptualized as an activity that requires so little energy that depressed people can continue to engage in it. Therefore, media use might also have positive effects on the users' mental health (Primack et al. 2018). In recent years, ample evidence has been generated for a link between depression and social media use. The focus of these studies was on how much, but also on how social media are used (Fardouly et al. 2017; Lin et al. 2016; Primack et al. 2018; Seabrook et al. 2016; Shensa et al. 2017; Twenge et al. 2017). These helpful and harmful effects on (mainly young) users' mental well-being seem to depend more on the "how" rather than on the "how much" (Burke and Kraut 2016; Primack et al. 2018): More passive forms of use contribute to negative outcomes such as a depressed mood (Escobar-Viera et al. 2018), loneliness (Primack et al. 2017), or low life satisfaction (Fardouly et al. 2017), whereas active engagement with others on social media might also have beneficial effects on well-being (Frison and Eggermont 2015a; Quinn 2018). These findings mostly stem from cross-sectional or experimental study design samples and are based on linear modeling as offered by default in most statistical packages.

However, the average daily time spent interacting on social media is only second to television (TV) use (The Nielsen Company 2016), and less relevant for older audiences than other traditional media in Europe (Nimrod 2017). "Traditional" media activities, such as TV, listening to the radio, or reading newspapers, magazines, and books have large audiences (eMarketer 2017; Nimrod 2017; Pew Research Center 2016), and link with depression (Bavishi et al. 2016; Cameron and Ferraro 2004; Goldfield et al.

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2016; Nowakowski et al. 2015; Primack et al. 2009), but are simply less in focus in today's research streams. Except for a few studies from the United States and Europe (Lin et al. 2016; Twenge et al. 2017), most research has employed convenience sampling and has primarily focused on young media users (exceptions are e.g., Cotten et al. 2012; Nimrod 2017), thus preventing generalizations to the general population. Doubtlessly, research on the Internet and particularly social media has substantially improved our understanding of the mechanisms that underlie the relationship between depression and media use. For instance, the "digital Goldilocks hypothesis" (Przybylski and Weinstein 2017) recently posited that the relationship between media use and mental well-being would be non-linear among adolescents: moderate screen use would come along with positive outcomes, while media over-engagement would displace people from healthier activities, but under-engagement can remove healthy opportunities bestowed by social media, too.

Despite this important theoretical progress, conceptual refinement seems plausible by not only conceptualizing the relationship to be inverse, i.e., that depression alters media use (e.g., Authors 2018), and applying it to the general population. Given the reduced activity levels and motivational differences associated with depression's symptomatology, it seems worthwhile to examine the extent to which depressive symptoms make the use of media more or less likely for which until now only implicit evidence can be found (i.e., a non-linear relationship as in Fig. 2 in Primack et al. 2009, p. 189). In fact, this rationale was only recently followed by Houghton et al. (2018) who modelled different trajectories of depressive symptoms over time (low-stable, high-decreasing, low-increasing) as predictors of social and screen media and thereby explicitly considered the relationship to be non-linear. Including non-linearity in the conceptualization and analysis is more sensitive since it includes additional variance that is otherwise discarded by building one pooled overall mean that may include both positive and negative effects. Moreover, non-linear analyses are more systematical in addressing potential displacement effects (Valkenburg and Peter 2007) or affordances of media use (Sundar and Limperos 2013), thereby allowing for more faceted conclusions (Przybylski and Weinstein 2017) that stress and facilitate the continuous and critical evaluation of research.

This paper addresses these aspects using a representative sample ($N = 2002$) of the German population, surveyed over the telephone (CATI methodology) regarding both their time spent using "traditional" media (TV, newspapers, the radio, magazines, books) and their different motives for using them. The prevalence of depressive symptoms was captured using the Beck Depression Inventory—a survey instrument to screen for depression in the general population (Schmitt et al. 2006, 2010). The paper therefore aims to answer the following three questions: (1) How do the motives for using traditional media, and (2) the time using such media vary as a function of depression, and (3) how can this function be described?

Depression and Media Use

The 10th revision of the International Classification of Diseases (ICD-10) system considers depression as an affective disorder with three main symptoms (Dilling et al. 2011): (1) a depressive mood; (2) loss of interest and joy; and (3) elevated tiredness, and reduced motivation and activity. Additional symptoms are sleep disturbances, reduced appetite, or reduced self-esteem. Even though classified as an affective disorder, depression also manifests as negative, self-destructive thought patterns that massively impact human cognition (Beck 1987). Beck's cognitive model of depression (Beck 1967; Beck et al. 1979) assumes that depressed individuals hold negative views of themselves, their world, and their future—the cognitive triad (Beck et al. 1979). This trifold negative cognitive schema results in low self-efficacy expectancies ("I can't do this"), low outcome expectancies ("the world is against me"), and the notion that the current situation will persist ("I won't change this"). Changing these cognitive thought structures is usually the goal of combined treatment protocols employing cognitive-behavioral therapy and medication (Beck 1967).

Arguably, the level of depression being experienced is likely to alter an individual's needs, such as the need for social connectedness, which can be fulfilled by using media. Traditional (also "old" or "legacy") mass media that has been used before the Internet was developed includes television, radio, newspapers, magazines, and print publications such as books, and are characterized by their asynchronous nature including separate roles of sender and receiver (Shannon and Weaver 1964). In contrast, "social media" such as Facebook, Instagram, YouTube, or Twitter describe primarily synchronous online networks that allow users to create content, connect with others, and get in touch with algorithmically filtered or personally recommended content. In this paper, we will particularly focus on traditional media, which are widely and still more regularly used among the general population in Germany, particularly among the elderly (Nimrod 2017).

Importantly, given the reduced activity levels associated with depression, media use might even be one of the few remaining activities to fulfill those needs (Authors 2016). Since the link between depression and media use almost entirely refers to conceptualizations of "how" and "how much" online and social media are used, the main lines of this research will be reviewed first. However, the lively discussion on the effects of social media on well-being also informs us about the main underlying mechanisms to examine when investigating the link between media use and depression in general.

Research has shown that the time spent in online communication can reduce depressive symptoms and stimulate well-being through the positive, stress-reducing effects of self-disclosure, social connectedness, and received online social support (Valenzuela et al. 2009)—in contrast to earlier concerns that online communication would displace people from obtaining valuable social support (Kraut et al. 1998; Morgan and Cotten 2003). However, this stimulation–displacement dichotomy (Valkenburg and Peter 2007) seems to be moderated by different types of online communication and by different personalities (Authors 2017; Frison and Eggermont 2015b).[1] Nevertheless, the time spent in online communication remains relevant given that total abstinence from social media ("Facebook detox") significantly enhances well-being (Tromholt 2016).

It is argued in the following two sections that both motives (i.e., the "how") and the extent to which media is used (i.e., the "how much") are relevant to understanding the relationship between depression and the use of old media in the general population. Ultimately, conceptual refinement can be achieved by also considering the relationship between depression and media use to be non-linear (e.g., Przybylski and Weinstein 2017), which will be discussed in a third step.

Depression and Media Use Motives

Uses and gratifications theory (Katz et al. 1973; Rubin 2009) conceptualizes media use as active and purposeful in fulfilling personal needs in relation to individual predispositions that might include depression, but also considers it to be passive and habitual. Basic needs therefore include information, communication, recreation, escape, or media use as a habit. These motives for using media have been updated to include new media contexts such as technology-driven affordances (Sundar and Limperos 2013) in addition to the socio-psychological gratifications that media use offers. For instance, a distinct technological affordance (which motivates users to spend time accessing various forms of media) makes users feel active when using the technology (see "activity"; Sundar and Limperos 2013, pp. 518–520). However, technological affordances still relate to basic media use motives. Therefore, to investigate associations between depression and the use of old media in the general population, basic media use motives would seem an appropriate avenue for study.[2]

Moreover, since depression is an affective disorder, mood management (Zillmann 1988a, b) might also be helpful in understanding why depressed people use media. The experienced emotions resulting from the use of different media content result in significant gratification. Recipients in an acutely negative, depressed emotional state might prefer highly absorbing (absorption potential), potentially distracting (hedonic valence), and not too exciting (excitatory potential) media content that is only weakly related to the causes of their depressed mood (semantic affinity). In theory, recipients can learn how to deal with different media content in order to effectively regulate their mood through operative conditioning—which is not necessarily a conscious process, and is one that is likely to habitualize and link media use with the affective incentives that come with mood management (Zillmann 1988a, b).

Importantly, depression might trigger more media use to compensate for reduced physical activity (Lucas et al. 2011). The social risk hypothesis of depression (Allen and Badcock 2003) posits that depressed people are particularly sensitive to feelings of disconnection and a lack of belonging (Baumeister and Leary 1995), and therefore they behave in a more risk-averse manner (i.e., less confident, less assertive, more submissive) to diminish the odds for social exclusion and to avoid ostracism—especially when mildly to moderately depressed (Dunn et al. 2012). Media can fulfill these functions for depressed people by providing parasocial contact, the room to escape from feelings of social exclusion, and potentially inclusive input for future social encounters. For instance, in the context of depressing life events, people with limited social contact watched TV to seek companionship (Minnebo 2005), and were more motivated to use more media to avoid loneliness, to pass the time, or to escape their everyday life problems (Perloff et al. 1983; Potts and Sanchez 1994). Dutta-Bergman (2005) found an increased interest in reading newspaper reports about 9/11, but also in gathering news information from TV and radio among participants roughly categorized as "depressed" in a national sample in the USA. It is therefore hypothesized:

> *H1: Basic motives for using media such as recreation, escape, communication, information, and habit will become more relevant when suffering from depression.*

[1] Empirical evidence supports the notion that more passive use links with lower well-being, whereas active social media use comes with more benefits. However, Frison and Eggermont (2015b) recently differentiated the publicness (private vs. public) with which Facebook is actively used, that depends on e.g., privacy settings, the goals, or the content of the communication. Hence, an active-passive differentiation of social media use might be conceptually a step forward (compared to simply focus on time budgets), but might as well not mark the end of that road. The argument in this article is that the link between media use (time) and depression is more complex than assumed by linear models. Hence, it would be beyond the focus of the present paper to elaborate more thoroughly on the active-passive/publicness discussion about social media use.

[2] For instance, Sundar and Limperos (2013) argue that technological affordances can help users to avoid viewing things they do not want to see ("filtering" which relates to the basic motivation of escape), or to easily compare their opinions with those of others ("bandwagon" which relates to the need to communicate), but technology might also create experiences of being elsewhere ("being there" in support of recreation), help to connect different information ("navigation aids" for information), or anticipate personal needs ("responsiveness" in support of media habits).

In turn, if people become increasingly motivated to use media for mood management to modify their mood and to escape from unpleasant mood states, to compensate for a lack of social contacts, to improve their social orientation, or to stimulate their habits, media will be used more extensively in those suffering from depression. A theoretical rationale for this will be provided in the following section.

Depression and Time Spent Using Media

Investigating how much depressed people use media is linked to identifying their needs. Given that the basic motives for using media gain relevance when depressed (Authors 2016; Selfhout et al. 2009), depression also relates to the amount of individual media use. Theoretically, the social cognitive model of media use (Bandura 2009; LaRose and Eastin 2004) provides us with a rationale. Based on social cognitive theory (Bandura 1986), the model postulates that media use is determined by outcome expectancies ("benefits from media use will help me to compensate for my depression"), self-efficacy beliefs ("I will keep using media, even though it's difficult for me to even get up"), and self-regulation ("I should not use media if I feel bad afterwards"), and it conceptualizes media use as an active process. However, depressive symptoms reduce self-efficacy (Maddux and Meier 1995), impair self-regulation (Brinkmann and Franzen 2015), and were hypothesized to foster media use through habitualization. Hence, media use should be driven by the expected outcomes of such usage. In fact, Lee et al. (2016) postulated that maximizing positive and minimizing negative outcome expectations toward using media would contribute to more habitual media use, and a higher use of media in general. In a nationally representative sample of adolescents aged 13 to 17 in Singapore, the study found support for this assumption regarding the use of social network sites. Thus, if the motivation underlying using media for their expected benefits increases, then media use should be more frequent.

Moreover, from a "cognitive budget" perspective, media routines do not require much conscious effort nor extensive cognitive processing. Hence, with the reduced cognitive resources associated with depression, routinized (i.e., "budget-saving") media use should be embraced, and this should, in combination with reduced self-efficacy and self-regulation, foster more media use as well. This pattern might actually reinforce itself, against the backdrop that media might have been used in the first place to compensate for depression-related social impairments and to profit from the perceived benefits of media use. Hence, habitualized, increased media use during depression and the beneficial outcome expectancies related to media use (e.g., recreation, escape) are likely to reinforce media use in future depressive episodes—especially given the reoccurring nature of depression. These theoretical assumptions were largely supported by empirical findings for both online and offline media use (Lin et al. 2016; Liu et al. 2015; Primack et al. 2009). It is therefore hypothesized:

> *H2: The time spent using media will be positively associated with depression.*

Both the second hypothesis and previous conceptualizations assume a linear relationship between depression and media use—the main notion revealed by research in recent years. However, in the following section, grounds for believing that the relationship between depression and media use is, in fact, non-linear will be presented.

Arguments for a Non-Linear Relationship between Depression and Media Use

Given the theoretical predominance of the stimulation–displacement dichotomy (Valkenburg and Peter 2007) that conceptualizes the impact of technology on humans to be directly proportional to exposure, explains why most studies approached the topic assuming that the association between depression and media use would be linear, and thus investigated the relationship with linear models as offered by default in most statistical packages (e.g., Lin et al. 2016; Liu et al. 2015; Primack et al. 2009). However, an increase in depressive symptoms does not automatically result in a decrease in activity levels. For instance, it has been shown that the association between depression and workplace activities with less physiological benefits, enjoyment, and social contact than sports activities, is positive and best described by a non-linear function (Harvey et al. 2010). Assuming media use is a comparatively light activity, yet with some socio-psychological benefits, one would expect correlations with depression to behave similarly. At least some empirical evidence can be found for this assumption. Przybylski and Weinstein (2017) found that the relationship between digital screen engagement and mental well-being can modelled as a linear function, but also as a concave-down quadratic function. Hence, linear models are not automatically wrong, but might be less exact or even oversimplifying regarding the relationship between media use and mental well-being. Importantly, it requires both depression and media use to be measured on a metric scale, both have to be reported per answer category instead of as a condensed correlation coefficient, and figures should preferably be based on a robust sample of the general population. Another example is a study by Liu et al. (2015) that identified seven reported measures from four studies that allowed them to perform a meta-analysis. Their findings support a dose–response relationship between depression and media use among children and adolescents. Additionally, one study of 9th-to-12th graders found the relationship between suicidal risk factors (arguably intertwined with depression and media use; see

Reinemann and Scherr 2011; Scherr 2013, 2016) and time spent using electronic devices per day to be non-linear (Twenge et al. 2017). And finally, in Fig. 2 of their article, Primack et al. (2009, p. 185) report on the daily use of TV and the radio to be stratified by depression, which supports the notion that the relationship between media use and depression is, in fact, curvilinear. To the best of our knowledge there is only one study (Houghton et al. 2018) that explored in how far depressive symptoms predict media use. Using latent growth curve models, the study highlights the importance of going beyond linear modeling and also considering more complex relationships between depression and media use.

In fact, the social risk hypothesis of depression posits that its adaptive mechanism takes place particularly in mild to moderate depressed mood states, whereas clinical states of depression, outside the mechanism's adaptive range, are likely to yield maladaptive behavior that actually contributes to the symptomatology of depression (Allen and Badcock 2003; Steger and Kashdan 2009). In fact, clinical levels of depression yielded both more (Steger and Kashdan 2009) and less (Rottenberg et al. 2002) reactivity. Hence, people with no or only a few depressive symptoms should use media to about the same extent as mildly or moderately depressed people (whose adaptive behavior aims at restoring a healthy mental state), whereas people with severe forms of depression should use media maladaptively; that is, to a significantly higher or lower degree. Therefore, the third hypothesis is:

> *H3: The relationship between the severity of depression and media use is non-linear.*

However, empirical evidence beyond online and social media use is still scarce, contrary to the epidemiology of depression in the general population. Moreover, addressing the non-linear nature of the relationship between media use and depression requires particular statistical procedures that are usually not included in the popular software packages. Finally, if the hypotheses found empirical support in the general population, this would have important implications for future modeling of the relationship between media use and depression. Importantly, non-linear models *are* included in standard statistical software, but they are simply not set as the default models. Hence, these findings could make researchers more aware of the alternative statistical models that can be employed when investigating the media–depression link.

Method

Participants and Procedure

Data stems from a cross-sectional probability sample from Germany. The survey focused on the associations between media use and mental well-being and aimed at identifying those associations that would then be investigated further in more detail via follow-up experimental studies. The final sample consisted of $N = 2002$ completed telephone interviews (CATI method; 51.3% female, age range: 18–99 years, $M = 48.92$, $SD = 17.32$; RR1 = .08, RR3 = .09; American Association for Public Opinion Research 2011), and is representative for the German population over 18 living in private households. The sampling procedure included both landline and mobile telephone numbers (see Peytchev and Neely 2013). Interview partners within households were selected using the last birthday method and a professional survey company with trained interviewers performed the interviews. The interviews began with general questions about media use and then turned, toward the end of the interviews, to individual characteristics, including depressive symptoms. The survey combined known media use patterns in the general German population with mental well-being measures, and was geared toward capturing the breadth of this relationship. Therefore, media that are widely used by large parts of the population were mainly included.

Measures

Doubtlessly, digital and social media are highly used by many adults in developed countries, particularly regarding Facebook and users under the age of 65 (Smith and Anderson 2018). Given the especially high social media use among emerging adults and their pervasive multiple-platform use (Smith and Anderson 2018), it does not come as a surprise that a lot of research focuses on well-being effects in this group of users. However, a recent cross-national study by Nimrod (2017) found that older Internet users are inclined to use traditional, synchronous mass media more than asynchronous, social media. Across nine European countries, older audiences consistently adhered more to well-known, traditional media practices with only a small minority actually using the new possibilities provided by digital and social media. Thus, we applied a broad focus on traditional media repertoires and media use in the general population (18+ years) and adjusted our instrument to the context in Germany. Different measures were used for traditional media and social media platforms,[3] thus making meaningful comparisons between the two impossible. Importantly, large-scale, representative surveys do not always allow researchers to capture constructs with longer, multi-item measures, but might well require pragmatic and cost-efficient decision-making instead. In

[3] The lack of standardized measures for social media use itself (i.e., not in conjunction with the use of traditional media) has been recently discussed by Sigerson and Cheng (2018) with valuable suggestions for future steps forward. However, comparisons between digital and traditional media use would be even more challenging, and needs separate attention as part of a methodologically driven research program.

the following paragraphs, we will illustrate how traditional media use and media use motives were measured, and then elaborate on the measure of depression and the control variables included in the regression models.

Media Use To measure how much time participants spent on average using different media (TV, print newspapers, print magazines, the radio (not Internet radio), and books (printed or e-books)) on a regular weekday, we asked for the estimated time in hours and minutes just as in the *ARD/ZDF-Langzeitstudie Massenkommunikation*, a long-term study on media use in Germany (see e.g., Ridder and Engel 2010). Answers were transformed into minutes and, for the comparability and interpretability of results, collapsed into quartiles. Zero minutes indicated the non-use of a medium. The median (*Mdn*) average time spent watching TV was 120 min/day (interquartile range [IQR] = 60–180), with 20 min/day spent reading newspapers (IQR = 0–45), 15 min/day spent reading magazines (IQR = 0–30), and 45 min/day spent reading books (IQR = 0–90). Participants listened to the radio for *Mdn* = 120 min/day (IQR = 30–300). As depicted in Table 1, 35.6% of the total sample did not read a newspaper on a daily basis, 37.8% read no magazines, and 25% read no books on an average day of the week.

Motives for Using Different Media The same long-term study inspired the wording of the questions to capture seven general motives for using different (offline and online) media (see Breunig and Engel 2015) following the long line of research on the uses and gratifications of media (Katz et al. 1973; Rubin 2009). Participants indicated to what degree the questions applied to them on a 7-point scale ranging from 1 (*not at all*) to 7 (*very much*). The seven items were "I use media…for information", "…for fun and entertainment", "…to be able to take part in conversations", "…to forget about everyday life", "…to not feel alone", "…to relax", and "…as a habit". The items were subjected to an exploratory factor analysis (EFA) in which items were retained if their factor loading was .32 or higher (see Carpenter 2017) (principal axis factoring (PAF) with Promax rotation; Eigenvalues >0; variance explained = 51.91%; Kaiser–Meyer–Olkin [KMO] = .730; Bartlett's test $p < .001$). An inspection of the pattern matrix revealed that the item "…for fun and entertainment" had small cross-loadings and it was therefore excluded from further analyses. Two items ("…to forget about everyday life", "…to not feel alone") loaded on the same factor ("coping") and were transformed into a mean index ($M = 2.67$, $SD = 1.51$, Cronbach's $\alpha = .63$). The remaining four items served as single indicators for different motivations behind media use (i.e., information, conversation input, relaxation, and habit). In the total sample, information was considered as the most important media use motive ($M = 6.0$, $SD = 1.3$) and coping the least important ($M = 2.7$, $SD = 1.5$). Media use for conversation input ($M = 4.4$, $SD = 1.8$), recreation ($M = 4.2$, $SD = 1.8$), and as a habit ($M = 3.8$, $SD = 1.9$) ranged somewhere in between (see Table 1).[4]

Depression Depressive symptoms were assessed using a validated German short form of the Beck Depression Inventory that is particularly suitable for depression screenings in non-clinical samples of the general population (Schmitt et al. 2010). However, three items were excluded, which were considered inappropriate for a personal telephone interview situation ("I have lost interest in sex completely", "I would kill myself if I had the chance", "I feel I am a total failure as a person"). Hence, participants were asked 17 items to indicate how often they, for example, "felt discouraged about the future", "had trouble falling asleep", or had "felt guilty" in the previous two weeks. A scale from 1 (*never*) to 7 (*very frequently*) was used. Complete answers to all 17 items were then transformed into a sum index in line with research on clinically relevant depressive symptoms (Cronbach's $\alpha = .89$; $n = 1961$; $M = 36.42$, $SD = 15.53$). Thus, the sum score can range between 17 and 119. Given the non-normal distribution of the depression score, it was collapsed into three categories: Participants who indicated having *never* (1) or *almost never* (2) experienced any symptoms (i.e., a sum score between 17 and 34) were grouped together as "low depression." Due to the reduced number of items, an adjusted cut-off score had to be calculated for clinically relevant depression, for which the original validation dataset could be used (Schmitt et al. 2010).[5] Those who reached the cut-off score (a sum score higher or equal to 57) were grouped as "high depression" given their increased likelihood for experiencing clinically relevant depression. Participants in the "medium depression" group had a sum score between 35 and 56. In the sample, 54.1% indicated (almost) never having experienced any depressive symptoms over the course of the previous two weeks, and were grouped as "low," 35.1% were classified as "medium," and 10.9% as "high" on the depression measure.

Covariates Five age groups (15–29y; 30–39y; 40–49y; 50–59y; 60y and older), sex (male, female), education level (lower secondary education/"Hauptschulabschluss"; mid-level secondary education/"mittlerer Schulabschluss"; high school diploma or a college degree), relationship status (in a committed relationship; not in a committed relationship), living situation (not living alone; living alone), employment status (employed/"erwerbstätig"; non-working), and region in which they lived (eastern states of Germany (former GDR); western

[4] The use of single items is surely not optimal from a psychometric point of view, but somewhat unavoidable in large-scale surveys in order to obtain acceptable response rates, to reduce total survey costs, and to dampen participant dropout due to the tiring and frustrating repetitiveness of a survey instrument (Fuchs and Diamantopoulos 2009).

[5] We want to thank Manfred Schmitt for providing us with the original scale validation dataset for calculating a cut-off value for the depression scale.

Table 1 Sample characteristics and associations with depression

		Depression			
	Total sample ($N = 2002$)	Low ($n = 1060$)	Medium ($n = 688$)	High ($n = 213$)	p
Media use motives (*M, SD*)[a]					
Information	6.0 (1.3)	6.0 (1.3)	6.0 (1.3)	5.8 (1.5)	.096
Conversation input	4.4 (1.8)	4.3 (1.8)	4.5 (1.7)	4.7 (1.9)	.008
Coping	2.7 (1.5)	2.3 (1.3)	3.0 (1.5)	3.6 (1.7)	<.001
Recreation	4.2 (1.8)	4.0 (1.8)	4.3 (1.8)	4.4 (1.9)	.002
Habit	3.8 (1.9)	3.6 (1.9)	4.1 (1.8)	4.2 (1.9)	<.001
Time spent with media in minutes (%)[b]					
TV					<.001
Q1 (0–60)	32.0	34.0	31.4	21.6	
Q2 (61–120)	28.4	30.0	26.3	27.2	
Q3 (121–180)	19.1	19.7	18.2	20.2	
Q4 (181+)	20.4	16.4	24.1	31.0	
Newspaper					.011
Q1 (0)	35.6	31.8	39.9	39.9	
Q2 (1–20)	17.2	18.4	16.3	15.5	
Q3 (21–45)	23.6	24.2	23.6	21.6	
Q4 (46+)	23.5	25.6	20.1	23.0	
Radio					.527
Q1 (0–30)	25.8	25.4	26.6	24.9	
Q2 (31–120)	29.8	30.9	29.3	26.8	
Q3 (121–300)	23.6	23.1	22.6	29.1	
Q4 (301+)	20.7	20.6	21.5	19.2	
Magazines					<.001
Q1 (0)	37.8	37.6	38.1	36.5	
Q2 (1–15)	18.7	20.5	17.4	13.3	
Q3 (16–30)	19.5	21.3	18.0	17.1	
Q4 (31+)	23.9	20.6	26.6	33.2	
Books					.036
Q1 (0)	25.0	23.2	28.1	25.4	
Q2 (1–45)	25.4	25.7	24.7	26.8	
Q3 (46–90)	25.2	27.7	21.7	20.6	
Q4 (91+)	24.4	23.3	25.5	27.3	
Covariates (%)[b]					
Sex					.027
Female	51.3	49.0	52.3	58.7	
Male	48.7	51.0	47.7	41.3	
Age					.008
15–29y	16.5	14.5	19.4	17.8	
30–39y	14.7	15.3	14.0	14.0	
40–49y	20.5	19.8	22.7	15.9	
50–59y	19.3	20.0	19.2	16.4	
60y +	29.0	30.3	24.6	36.0	
Relationship					<.001
In a committed relationship	69.4	72.8	69.1	53.1	
Not in a committed relationship	30.6	27.2	30.9	46.9	
Living					<.001
Not living alone	72.9	76.3	72.5	60.1	

Table 1 (continued)

	Total sample ($N = 2002$)	Depression			p
		Low ($n = 1060$)	Medium ($n = 688$)	High ($n = 213$)	
Living alone	27.1	23.7	27.5	39.9	
Employment[c]					<.001
Employed	62.5	66.4	61.7	45.1	
Non-working	37.5	33.6	38.3	54.9	
Education level[d]					<.001
lower secondary education	32.6	29.0	33.8	48.5	
mid-level secondary	34.8	36.6	32.6	33.2	
high school diploma or higher	32.6	34.4	33.5	18.3	
Region[e]					.162
Eastern states of Germany	16.9	15.4	18.5	19.1	
Western states of Germany	83.1	84.6	81.5	80.9	

$n = 2002$; data is representative for the German population over 18 years; depicted figures based on weighted sample analyses

* $p < .05$ ** $p < .01$ *** $p < .001$

[a] P values based on the F-test statistics for media use motive means as indicated by an ANOVA with depression level as the grouping variable

[b] P values based on the χ^2-test statistics for observed and estimated proportions of survey participants in each category

[c] "Non-working" status includes unemployment, retirement, as well as houseman/housewife status

[d] Education levels were „Volks-/Hauptschulabschluss"(= low), „mittlerer Abschluss"(= mid), „(Fach-)Hochschulreife und höher"(= high)

[e] East German states (former GDR) were defined by their ZIP codes starting with 0xxxx, 1xxxx, 39xxx, 98xxx, 99xxx, as well as from 23,923 to 23,999. Eastern states were coded as 0, Western states as 1

states of Germany) were included as covariates in the analyses. All covariates were included in all multivariate models. In order to take advantage of the nationally representative sample, adjustments to the general population were made regarding sex, age, and formal education using mean square error (MSE) trimmed survey weights (Potter 1990) in all analyses.

Results

A total of 2002 participants finished the survey. Of the participants, 51.3% were female, 69.4% were in a committed relationship, 72.9% reported not living alone, and 62.5% indicated that they were employed. About one third (32.6%) indicated having completed lower secondary education, one third (24.8%) indicated some mid-level secondary education, and around one third (32.6%) had a high school diploma or a degree from a higher education institution (see Table 1). In terms of regional differences, 16.9% of the participants indicated that they were from former East Germany. Differences between responders and non-responders could not be investigated, since the survey company reported no information.

Bivariate analysis revealed that depression is associated with a stronger motivation to use media as a form of coping ($F = 96.407$, $p < .001$, part. $\eta^2 = .08$), and as a habit ($F = 20.311$, $p < .001$, part. $\eta^2 = .02$), associations were smaller with media use in terms of gaining conversational input ($F = 4.875$, $p = .008$, part. $\eta^2 = .005$), or for relaxing ($F = 6.433$, $p = .002$, part. $\eta^2 = .007$), and no significant relationship was observed for information ($F = 2.342$, $p = .096$, part. $\eta^2 = .002$). However, it is likely that a ceiling effect was observed for the latter motive, given the very high agreement to this particular item. The average agreement with the five motive categories stratified for depression are depicted in Table 1. Taken together, the data partially supported the first hypothesis (H1) that depression is associated with an increase in basic media use motives with the exception of information. Information seeking was extremely important, independent of the depression severity.

Moreover, there were significant differences in depression for all media use variables except for the radio, sex, age, relationship status, living situation, employment status, and formal education (see Table 1). There were no regional differences in depression. Being female (Cramer's $V = .061$, $p = .027$), not being in a relationship (Cramer's $V = .129$, $p < .001$), living alone (Cramer's $V = .111$, $p < .001$), non-working status (Cramer's $V = .134$, $p < .001$), and a lower level of formal education (Kendall's tau-b = −.093, $p_{approx} < .001$) were associated with higher depression; age (Kendall's tau-b = −.032, $p_{approx} = .114$) or region (Cramer's $V = .044$, $p = .162$) were not.

Depression was associated with higher TV use (Kendall's tau-b = .096, $p_{approx} < .001$), and magazine use (Kendall's tau-b = .043, $p_{approx} = .034$), but with lower newspaper use (Kendall's tau-b = −.067, $p_{approx} = .001$). No such associations could be found for radio listening (Kendall's tau-b = .006,

$p_{approx} = .752$) or book reading (Kendall's tau-b = −.018, $p_{approx} = .372$). Hence, H2 only holds true for the increased use of some media with depression (TV, magazines), but must be rejected for the other investigated media (newspapers, the radio, books). Overall, given that the association with newspaper use was in fact opposite to the hypothesis, we reject H2.

Moreover, in order to test the third hypothesis, a total media use measure was computed as the sum of time spent using the TV, newspapers, the radio, magazines, and books. As can be seen in Table 2, total media use was different for all covariates except for sex (see Table 2). Media use was positively associated with a lower education (Kendall's tau-b = −.256, $p_{approx} < .001$), age (Kendall's tau-b = .193, $p_{approx} < .001$), non-working status (Cramer's $V = .166$, $p < .001$), living alone (Cramer's $V = .127$, $p < .001$), not being in a relationship (Cramer's $V = .071$, $p = .018$), and living in East Germany (Cramer's $V = .070$, $p = .021$).

In order to investigate the relationship between (total) media use and depression (≥ cut-off), as hypothesized, an ordered logistic regression with sample weights was run first. All covariates were included in this analysis (see Fig. 1). Based on the adjusted odds ratios (AOR), participants in the second (total) media use quartile had lower odds for depression (Q2: AOR = 0.93, 95%-CI [0.57, 1.52]), whereas the odds for

Table 2 Associations between covariates and media use

	Total media use in minutes[a]				
	Q1 ($n = 519$)	Q2 ($n = 515$)	Q3 ($n = 471$)	Q4 ($n = 498$)	p[b]
Covariates (%)					
Sex					.480
Female	51.4	48.3	46.6	48.2	
Male	48.6	51.7	53.4	51.8	
Age					<.001
15–29y	22.7	17.8	15.2	9.9	
30–39y	19.6	14.7	12.2	12.3	
40–49y	26.8	17.2	19.1	18.8	
50–59y	18.8	22.5	18.8	16.8	
60y +	12.1	27.8	34.7	42.2	
Relationship					.018
In a committed relationship	71.7	72.9	68.7	64.4	
Not in a committed relationship	28.3	27.1	31.3	35.6	
Living					<.001
Not living alone	79.3	76.5	71.2	64.6	
Living alone	20.7	23.5	28.8	35.4	
Employment[c]					<.001
Employed	73.0	66.5	57.4	52.3	
Non-working	27.0	33.5	42.6	47.7	
Education level[d]					<.001
lower secondary education	16.2	33.7	30.4	50.4	
mid-level secondary	32.5	31.9	42.0	33.6	
high school diploma or higher	51.3	34.5	27.7	16.0	
Region[e]					.021
Eastern states of Germany	14.7	14.1	18.1	20.6	
Western states of Germany	85.3	85.9	81.9	79.4	

$n = 2002$; data is representative for the German population over 18 years; depicted figures based on weighted sample analyses

* $p < .05$ ** $p < .01$ *** $p < .001$

[a] Total media use reflects the sum of time (in minutes) spent using TV, newspapers, radio, magazines, and books on an average day. Quartiles were Q1 (0–249 min), Q2 (241–390 min), Q3 (391–600 min), and Q4 (601 min and more)

[b] P values based on the χ^2-test statistics for observed and estimated proportions of survey participants in each category

[c] "Non-working" status includes unemployment, retirement, as well as houseman/housewife status

[d] Education levels were „Volks-/Hauptschulabschluss"(= low), „mittlerer Abschluss"(= mid), „(Fach-)Hochschulreife und höher"(= high)

[e] East German states (former GDR) were defined by ZIP codes that started with 0xxxx, 1xxxx, 39xxx, 98xxx, 99xxx, as well as from 23,923 to 23,999

participants in the third (Q3: AOR = 1.28, 95%-CI [0.79, 2.07]) and fourth (Q4: AOR = 1.19, 95%-CI [0.74, 1.91]) quartiles were greater as compared to participants with the lowest media use (Q1)—however, not significantly. Hence, we found no support for H3 regarding overall media use.

However, the relationship between *total* media use and depression seemed more complex and not necessarily linear as assumed in Fig. 1. Hence, the relationship between the use of *different* media and depression was examined more in detail using curve fitting techniques. Curve fitting uses non-linear regression analysis to find the simplest model possible that comes closest to the data on media use and depression. The result of this iterative process can be assessed through best-fit indicators. Out of the many possible non-linear functions, the relationship between depression and media use was modeled as a linear (left column), quadratic (mid column), and cubic function (right column; see Fig. 2). From a primarily data-driven standpoint, more complex non-linear functions might have described the data more accurately, but they would have been more difficult to explain and to integrate conceptually. Thus, a quadratic and a cubic function served as exemplars for a non-linear relationship between depression and media use. Model fit was assessed using the R^2 and Akaike information criterion (*AIC*) values of the fitted model, as well as tests for lack-of-fit (F-replicate values; Draper and Smith 1998). For the reader's convenience in assessing the *e*vidence for the *i*-nadequacy of the *m*odel *f*it, this information was also condensed into an *EIMF* indicator for each model (see Table 3).

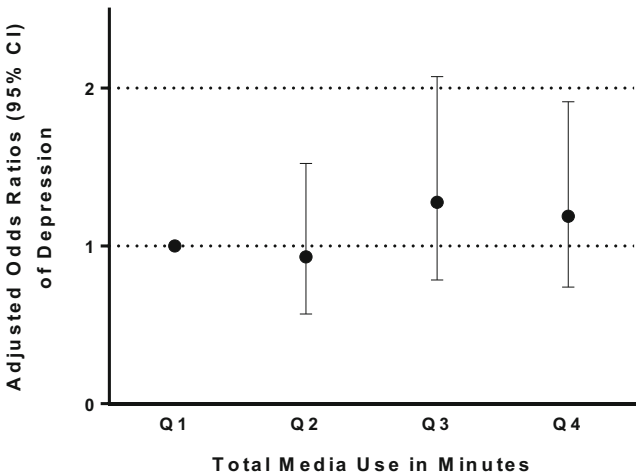

Fig. 1 Associations between total media use and depression assuming an overall linear relationship. Total media use reflects the total amount of time spent using TV, newspapers, radio, magazines, and books divided into quartiles from lowest (Q1) to highest (Q4). Vertical bars represent the upper and lower 95% confidence intervals of the point estimates of adjusted odds ratios. Odds ratios adjusted for sex, age, education level, relationship status, living situation, employment status, and region of living. $n = 1985$, *Wald* $\chi^2 = 90.05$, $p < .001$, *Pseudo-*$R^2 = .04$

Based on these assessment criteria, curve fitting shows that the relationship between depression and the use of newspapers, the radio, magazines, and books can be adequately described as a cubic function; magazines and books can also be described as a quadratic function. The relationship with TV could not be adequately fitted with these three functions; a more complex quadratic function, however, might be adequate upon the visual inspection of Fig. 2.

Discussion

The present study examined the association between depression and media use. Most of the research and conceptual development in recent years has been carried out on social media. A very good argument for this is that depression has an early onset and is prevalent among young media users. However, the highest prevalence of depression across the globe can be found in much older age groups than that of college students, who still use "old" media such as the TV, newspapers, the radio, magazines, and books a great deal.

Drawing on findings from social media, media use can have both positive (e.g., social support; Valenzuela et al. 2009) and negative (e.g., displacement from social support; see Kraut et al. 1998) effects on mental well-being, depending on "how much", "how", and "by who" media are used (Authors 2017; Frison and Eggermont 2015b). This mechanism was assumed to hold true for old media given the similar basic use motives such as distracting oneself, or knowing what is going on in the world around oneself. Since media use motives influence how much media are used (Katz et al. 1973; Rubin 2009), and that media use gains in importance with depression (Authors 2016; Selfhout et al. 2009), media use was hypothesized to increase in those suffering from depression.

The main findings of this study include a substantial decrease of moderate TV use (up to 60 min per day), and a substantial increase of high TV use (more than 3 h per day) in depression. Similarly, magazine use increased substantially in depression, and the highest (total) use of old media use was observed among people over 60 years; media were used more as a habit and to cope with life stressors. These media might provide content that offers good ground for social comparisons with positive implications (e.g., Mares and Cantor 1992), and that is less available and/or more strenuously accessible elsewhere (e.g., on the radio, in newspapers, or books). Participants turned more to the media to forget about their everyday life and to not feel alone, the more depressed they were, and ideally, this happened with the good intention to overcome depression. However, it might also bear the risk for maladaptive coping (Thompson et al. 2010).

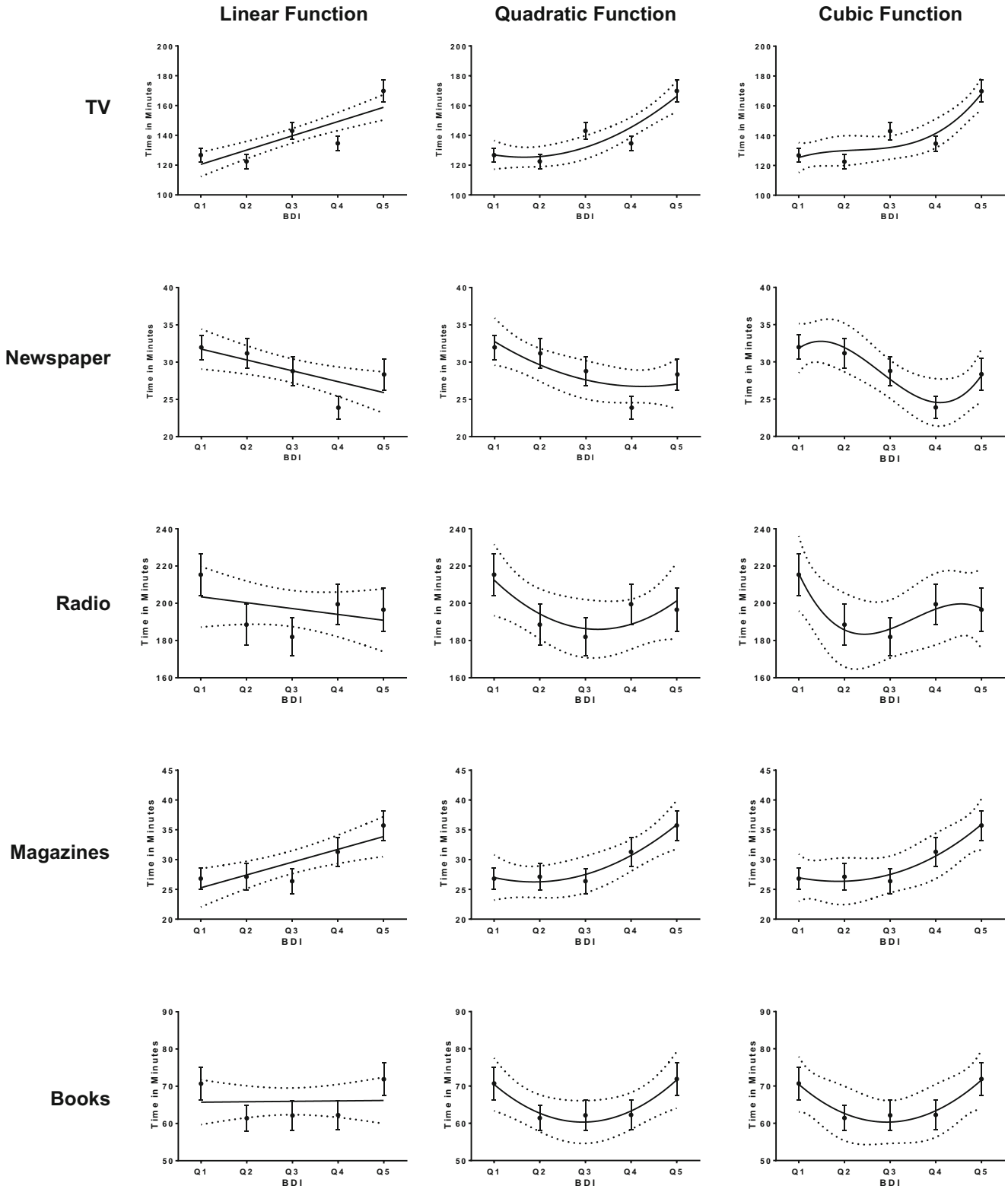

Fig. 2 Use of different media as linear and non-linear functions of depression. Media use (in minutes) varies with the strength of depression divided into quintiles from lowest (Q1) to highest (Q5). Data points reflect the mean media use time with standard errors. The bold lines represent fitted linear (left column) and non-linear (i.e., quadratic, cubic) regression functions, for which the dotted lines show the 95% confidence band

Table 3 Model fit indices of the curve fitting procedure

		df	R^2	*AIC*	$F_{replicate}$	$p_{replicate}$	*EIMF*
TV	Linear	1949	.998	66.89	4.727	.003	Yes
	Quadratic	1948	.998	66.88	4.059	.017	Yes
	Cubic	1947	.998	66.88	6.893	.009	Yes
Newspaper	Linear	1954	.998	55.75	1.882	.131	No
	Quadratic	1953	.998	55.75	2.121	.120	No
	Cubic	1952	.998	55.74	0.666	.414	No
Radio	Linear	1957	.998	73.79	1.538	.203	No
	Quadratic	1956	.998	73.79	0.801	.449	No
	Cubic	1955	.998	73.78	0.257	.612	No
Magazines	Linear	1951	.998	57.56	1.090	.352	No
	Quadratic	1950	.998	57.56	0.232	.793	No
	Cubic	1949	.998	57.56	0.458	.499	No
Books	Linear	1944	.998	63.76	2.128	.095	No
	Quadratic	1943	.998	63.74	0.174	.841	No
	Cubic	1942	.998	63.74	0.346	.556	No

R^2 quantifies the goodness of fit by indicating how close the curve came to the points similar to linear regression. The *AIC* model comparison coefficient shows how well the data supports each model (for a specific medium) and takes into account both the sum-of-squares and the number of parameters in the model. Lower *AIC* values are preferable. The $F_{replicate}$ value indicates how far the fitted curve is from the data points with small values being indicative of a good model fit. Finally, a high $p_{replicate}$ value (>.05) indicates that the data do not follow a model different from the chosen one, which is desirable for a fitted model

EIMF = Summary indicator answering the question whether there is any "*E*vidence of *I*nadequate *M*odel *F*it"

Maybe the most important contribution of this paper that has not been considered by other research is that activity levels do not increase with depressive symptoms as a linear function. This has been shown for physical activities (Harvey et al. 2010), and has been observed (without saying it out loud) for media use (see Fig. 2 in the publication by Primack et al. (2009, p. 185)), but remained excluded from the mostly linear models of media use. Mood management theory (Zillmann 1988a, b) and the social risk hypothesis of depression (Allen and Badcock 2003), suggest that people with mild to moderate depression would adjust their media use in order to regulate their mood and to reduce their risk of (future) social exclusion, whereas clinical states of depression would be maladaptive (i.e., contribute to the depressive symptomatology) and yield significantly more or less media use—hence, describing a non-linear relationship between depression and media use. Curvilinear, maladaptive patterns between depression and media use have previously been observed for the relationship between depression and presumed media influences (see Scherr and Reinemann 2011).

Based on a representative sample of the German population over 18 years old, the relationship between depression and media use was investigated. Participants were surveyed via the telephone about their motives for and amount of media use. The depression measure has been employed to screen for depressive symptoms in the general German population, and a validated cut-off value could be calculated (Schmitt et al. 2010). Using curve-fitting methodology, cross-sectional evidence was compiled that the relationship between depression and the use of newspapers, the radio, magazines, and books is best described as a cubic function, and should therefore be modeled as such in future research. For TV use, however, a more complex quadratic function might be adequate following a visual inspection.

In contrast to linear models, non-linear (i.e., quadratic or cubic functions) models allow more detailed conclusions from the same data. For instance, linear models suggest a positive correlation between depression ad TV and magazine use (see left column in Fig. 2), but a negative correlation with reading newspapers and listening to the radio, and no correlation with reading books. However, this rough approximation might statistically not perform particularly well when it comes to explaining observed variance (see the means and their standard errors outside of the 95% confidence bands in Fig. 2), and could be theoretically questioned given the differences in media use between people with a more and less severe symptomatology of depression (Authors 2011, 2016). Therefore, non-linear models that acknowledge that the relationship between depression and media use has one or more inflection points are theoretically more accurate, and add explanatory power to the analysis. For example, the use of books is higher when depressive symptoms are very low *or* very high, whereas listening to the radio strongly decreases with accumulating symptoms of depression, only slightly increases in mid to higher depression levels, and remains stable in severe depression. A similarly shaped curve describes the relationship between depression and newspaper use more accurately than simply assuming a linear negative correlation (as indicated by the lower $F_{replicate}$ values in Table 3). Finally, non-linear models contain extra information that is useful for theoretical progress: For instance, higher newspaper use can be interpreted as a sign of low(ering) depressive symptoms based on the overall negative linear relationship, but could in fact be indicative of more severe depressive symptoms assuming that the relationship is non-linear.

Importantly, studies that include older people's "old" media use *and* depression are rare, even though the prevalence of depression is highest among them. Therefore, these findings based on the general population, including both younger and older age groups, and a clinical measure for depression, might be useful for future research. The found non-linear relationship between depression and media will help researchers to refine both their conceptualization of depression and media use and their data analysis. Moreover, these findings do not contradict the research on social media and depression. Instead, the present study shows that in the general population

(i.e., beyond student samples), depression is a relevant individual variable to consider for media use in more general terms (at least regarding the heterogeneity of users and the spectrum of relevant media to look at). These findings are of importance because today, and in the near future, depression can be seen as a leading cause of the global disease burden, with millions of people worldwide being restricted by it (Wittchen et al. 2011).

The finding that depression was not correlated with the motivation to use media for information can be seen opposite to previous claims such as "no news, is good news" (Potts and Sanchez 1994). Apparently, using media for information has been regarded extremely important in this sample, largely independent of the severity of depressive symptoms. In fact, (Potts and Sanchez 1994) did not find a correlation between depression and watching news for information either. However, their paper-and-pencil survey yielded less skewed answers to this question. One explanation might be that socially desirable answering produced a ceiling effect on the agreement to information importance in the telephone interviews. Conceptually, a fear of social exclusion as suggested by the social risk hypothesis of depression (Allen and Badcock 2003) and a ruminative self-focus might foster information seeking as well (Beck 1967; Beck et al. 1979).

Limitations

This study has important limitations typically linked with large-scale, cross-sectional telephone surveys in Germany. First, the wording of the questions used in this study was somewhat general. This is strongly linked with its design being the first representative telephone survey in Germany to capture clinically relevant depressive symptoms (among other health indicators) together with media use. For instance, specific books that had been read or the specific TV programs that had been watched were not captured. Second, and related to that, our study only speaks to cross-sectional relationships. The temporal causality between depression and media use cannot be ruled out, which future studies will have to address. Moreover, the survey response rates and their implications for the generalizability of the findings could be questioned. It is important to note that Germany is probably the "most survey-critical" country in the world (see e.g., Pforr et al. 2015, p. 741), and response rates have continuously decreased worldwide over recent years, especially for telephone surveys (e.g. RR3 = .09 for telephone survey conducted by the Pew Research Center in 2012; see Pew Research Center 2012). Future studies might therefore also wish to consider different study designs and measures to capture depression. Observational data from professionals could, for instance, also be included instead of the validated self-report version of the Beck Depression Inventory (Schmitt et al. 2010). Finally, given other studies found associations between media multitasking and depression (e.g., Becker et al. 2013), future studies should also explore this important aspect.

Conclusion

While some people suffering from depression might use media more intensively as a distraction from their symptoms, to stay connected with other people, or to exchange information with others about their well-being in self-enhancing ways, others might not use media at all. In both cases, media use can have positive and negative consequences. This study shows that depression is associated with media use across a wide range of age groups and different media, not only social media. The relationship between media use and depression has been shown to be non-linear in the general population. It seems as if people purposefully use media to shed some light on their lives, and, depending on their depressive symptomatology, to enable them to positively adapt to social impairments.

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Compliance with Ethical Standards

Conflict of Interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

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