

Aberystwyth University

Health among humorists

Greengross, Gil; Martin, Rod A.

Published in:

Humor

DOI:

[10.1515/humor-2017-0054](https://doi.org/10.1515/humor-2017-0054)

Publication date:

2018

Citation for published version (APA):

Greengross, G., & Martin, R. A. (2018). Health among humorists: Susceptibility to contagious diseases among improvisational artists. *Humor*, 31(3), 491-505. <https://doi.org/10.1515/humor-2017-0054>

General rights

Copyright and moral rights for the publications made accessible in the Aberystwyth Research Portal (the Institutional Repository) are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the Aberystwyth Research Portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the Aberystwyth Research Portal

Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

tel: +44 1970 62 2400
email: is@aber.ac.uk

Title: Health among comedy performers: Susceptibility to contagious diseases among improvisational artists.

Abstract

There is a widely held belief that humor contributes to better health, but the research on this topic yields mixed results. To assess the relationship between humor and health, we compared the susceptibility to various infectious diseases of 511 comedy performers (amateur improvisational artists) and a control group of 795 non-performers that were matched to the comedy performers sample in age and sex. Subjects reported the number of episodes and the total days they had had various infectious diseases. Contrary to the prevailing sentiment that humor boosts health, results showed that the comedy performer group reported more frequent contagious diseases and more days having these infections diseases, compared to the control group. Improv artists had significantly more infections and reported more days infected than the control group on respiratory infections, head colds, stomach or intestinal flu, skin infections, and autoimmune diseases. The control group had significantly more bladder infections with non-significant difference on days infected. Results held after controlling for BMI, age, number of antibiotics used and neuroticism. We found no evidence that humor positively contributes to health, and a career in a humor-related profession may be detrimental to one's health. Our research highlights the complex relationship between humor and health outcomes.

Introduction

There is a widely held view among both health professionals and the general population that a good sense of humor and laughter contribute to an individual's physical and mental health (McGhee 1996; McGhee 2010). This view became very popular following Norman Cousins' autobiographical account of recovering from a serious illness by watching comedy films (Cousins 1979; Cousins 1985). However, research conducted on the relationship between humor and health has produced mixed results (R.A. Martin 2001; Kerkkanen, Kuiper & Martin 2004; R.A. Martin 2007).

One of the challenges in assessing the relationship between humor and health is that both are defined and assessed in various ways, thus contributing to the conflicting and mixed associations between the two (R.A. Martin 2001; R.A. Martin 2007). There is no agreed-upon definition of what exactly a sense of humor entails, and researchers debate the nature of humor itself (Long & Graesser 1988; R.A. Martin 1998; Provine 2000; Ruch 2004; McGraw & Warren 2010; Hurley, Dennett & Adams Jr. 2011; Greengross & Mankoff 2012; O'Shannon 2012). Humor can be seen as a personality trait, mood, cognitive ability, mode of communication, or a defense mechanism, and includes social, developmental, emotional, cognitive, and biological aspects (O'Quin & Derks 1997; Gervais & Wilson 2005; Mobbs, Hagan, Azim, Menon & Reiss 2005). Each of these components, separately and in combination, can potentially contribute to both physical and mental health. For example, a person who has a humorous outlook on life and tries to find humor in everyday experiences appears very unlike a person who has a serious disposition but enjoys comedy movies and laughs at other people's jokes. Both of these could be

said to have a sense of humor, even though their daily uses of it are quite different. Each humor type could potentially yield unique health benefits.

Similarly, studies investigating how humor may affect health have looked at different components of health, such as immunity, blood pressure, pain tolerance, heart rate, and self-reported symptoms of illness (R.A. Martin 2001; R.A. Martin 2007). A number of studies conducted on the subject have consisted of laboratory experiments which focus on the short-term effects of humor on various health-related variables. For example, studies that exposed participants to humor stimuli such as a comedy film or written jokes found that humor can reduce stress-related physiological arousal (Abel & Maxwell 2002), increase pain tolerance (Weisenberg, Raz & Hener 1998), or enhance components of the immune system (Lefcourt, Davidson-Katz & Kueneman 1990). However, many of these studies had methodological weaknesses, including small sample sizes and inadequate control groups, and results have been inconsistent (R.A. Martin 2001).

As with the lab experiments, correlational research on the subject is also conflicted, and no clear relationship emerges (R.A. Martin 2001). For example, Fry (1995) found that self-reported measures of physical symptomatology negatively correlated with scores on situational and coping humor questionnaires, and Simon (1990) discovered a positive correlation between health perception measures and a situational humor questionnaire. However, other studies failed to find any relationship between sense of humor and illness symptoms (Porterfield 1987; Anderson & Arnoult 1989; McClelland & Cheriff 1997). Furthermore, observed associations between self-reported measures of sense of humor and health symptoms may have been confounded with neuroticism, a known factor that negatively correlates with humor scales and

positively correlates with self-report illness symptom questionnaires (Watson & Pennebaker 1989; Kohler & Ruch 1996; Greengross & Miller 2008).

One way to examine the link between sense of humor and health is by comparing the health of individuals with a greater sense of humor to those with lower humor ability. In one longitudinal study, the Terman Life-Cycle Study of Children with High Ability, researchers followed a large number of highly gifted individuals (average IQ of 151) many decades after they were first tested (Friedman, Tucker, Tomlinson-Keasey, Schwartz, Wingard & Criqui 1993; L.R. Martin, Friedman, Tucker, Tomlinson-Keasey, Criqui & Schwartz 2002). The researchers found that those who were rated as having a better sense of humor as children by their parents and teachers, were more likely to smoke and consume alcohol as adults and died at a younger age as compared to those with less humor, possibly because their cheerful personality made them discount the risks of their unhealthy choices and lifestyle.

A study by Edwards and Martin (2012) also found potential links between sense of humor and less healthy lifestyle. They found that higher scores on both affiliative and aggressive humor styles were associated with greater substance use (tobacco, alcohol, marijuana, and cocaine) among university students. These links were partially mediated by scores on a measure of seriousness, indicating that higher levels of substance use in individuals who engage more in these interpersonal styles of humor may be due in part to having a less serious, or more playful, outlook on life and therefore less concern about associated health risks.

Examining people who pursue a career in humor-related professions could support the possible connection between humor and health. If humor positively influences health, then comedy performers, who frequently engage in humor-related activities, such as writing and

telling jokes, should exhibit better health outcomes. Professional stand-up comedians are one such vocational group that experience humor on different levels daily (Janus 1975; Fisher & Fisher 1981; Greengross, Martin & Miller 2012). Comedians devote large amounts of time to writing and practicing their acts that they perform on stage, and their work dictates constant deliberation on funny material.

Several studies have focused on the possible long term relationship between humor and health among stand-up comedians, and specifically on the longevity of comedians. Rotton (1992) reported a series of four studies looking at the longevity of male comedians in comparison to other male entertainers. The results showed that there was no significant difference in the life span of stand-up comedians and humor writers in comparison to other entertainers and serious writers. These results were also true even when humor writers were matched with serious writers on the year they were born and for various causes of death. Moreover, comedians, humor writers, and serious entertainers died younger, compared to people who achieved fame in other areas. Likewise, a more recent retrospective study on 53 of the most successful male British comedians of all time (based on an online ranking) found that higher ranked comedians also had an increased mortality rate (Stewart & Thompson 2015). In another retrospective study, the longevity of stand-up comedians was compared to comedy actors and dramatic actors, all considered top-ranked in their respective profession, based on an online ranking (Stewart, Wiley, McDermott & Thompson 2016). As with the previous studies, results showed that being a stand-up comedian was not associated with longer life. In fact, stand-up comedians died at a younger age than both comedy and dramatic actors.

Studies on other performing artists reveal similar results. One study compared the age of death of performing artists such as singers, actors, and dancers, to other non-performing creative workers that included writers, composers, painters, and photographers (Epstein & Epstein 2013). The researchers looked at a thousand obituaries published every day for three years in the New York Times, and found that performing artists died at an average age of 77.2, compared to non-performing creative workers with an average death age of 78.5. Other high achieving groups included in the study such as academics, politicians, business people and people with military careers died at an even later age (81.7 years, 82.1, 83.3 and 84.7 respectively). It is interesting to note that performers and creative people tended to die at higher rates from cancer, compared to other groups.

Although there is little evidence that a career as a comedian or humor writer prolongs life, it is possible that the prevalence of humor in their lives associated with their work can affect their health by other means. The relatively shortened lifespan of comedians might have more to do with their lifestyle, rather than inherent physiological robustness. One possible health outcome that is less likely to be affected by unhealthy lifestyle is the incidence of infections. Susceptibility to infectious diseases is largely dependent on the immune system of the individual, and these illnesses are unlikely to be ignored, even if the person decides not to seek professional health care to treat them. Resistance to infections, especially respiratory disease, is commonly used as a measure of immunocompetence, as a marker for good health (Thornhill & Gangestad 2006; Gangestad & Grebe 2014).

The current study aimed to examine whether comedy performers have better health than non-performers by comparing their self-reported susceptibility to various infectious diseases.

Our research on the health of comedy performers differs from previous studies conducted on this topic in at least six different ways. 1) We are the first to examine a health outcome pertaining to comedy performers' immune systems, whilst most other studies focused on the longevity of the humorists. 2) Unlike other studies, most of the comedy performers in our study are unknown to the public and in early to mid-stages of their careers. By not focusing on the most famous and successful comedy performer, we alleviate some of the possible confounding effects associated with fame and wealth. 3) Our sample includes a large number of female comedy performers, an under-represented group in most other studies. Studies show that there are relatively few female humorists in most humor professions, with estimates varying between 10%-15% for comedians and cartoonists (Samson & Huber 2007; Greengross & Miller 2009; Greengross et al. 2012; Greengross 2014). By focusing on active comedy performers, many of them in the early stages of their careers, we were able to recruit more women. 4) To avoid demographic confounds, we made every effort to match our control group of non-performers on age and sex. 5) We controlled for several possible confounding variables that may affect health outcomes, in particular neuroticism, a factor that has been shown to positively correlate with self-report illness symptom questionnaires (Watson & Pennebaker 1989; Greengross & Miller 2008; Lahey 2009). 6) Our sample of comedy performers is large compared to other studies, and includes a unique group of improvisational (improv) artists.

Improv artists work cooperatively as a group to produce a spontaneous performance on stage (Salinsky & Frances-White 2013; Attardo 2014). Unlike stand-up comedians, improv artists do not prepare and practice their jokes in advance but rather base their act on a precontracted set of rules, within which they have the freedom to create and engage with others

on stage. While comedians' work is mostly solitary, and they have little interaction with other comedians apart from the day they are scheduled to perform, improv artists constantly work and practice together to sharpen their performance and hone their comedic skills. By surrounding themselves with others, and as both creators and consumers of humor, improv artists may increase the amount of humor they experience, and are in a unique position to reap any health benefits that might come with a humorous lifestyle.

Methods

Data Sources

We recruited 511 improv artist students (287 men, 224 women) online, from the Upright Citizen's Brigade Training Centers in New York and Los Angeles. Participants had an average age of 28.0 years ($SD = 5.64$), with an average of 16.12 years of education ($SD = 1.46$). The students had performed on stage as amateurs for an average of 1.8 years ($SD = 2.91$). Our comparison group was recruited online and consisted of 795 participants (495 men, 300 women). The average age of the participants in the comparison group was 28.44 ($SD = 6.77$), with an average of 15.47 years of education ($SD = 2.73$). There were no significant differences between the groups in age, but the improv artists were slightly more educated than the control [mean difference = 0.66 years ($S.E. = 0.13$), $t(1265) = 5.65$, $p < .001$]. All participants signed electronic consent forms prior to participating in the study and were debriefed after they completed the questionnaires.

Measures

Demographic and anthropometric information. Participants completed a short demographic questionnaire that included items regarding age, education, height and weight. Body mass index (BMI) was calculated as weight (kg)/height (m)².

Health questionnaire. An expanded version of Thornhill and Gangestad's (2006) health history questionnaire was used. The questionnaire asked participants to list the number of episodes and the total days they had had each of the following infectious diseases in the past three years: Respiratory (chest) infections (e.g. persistent cough, pneumonia), head colds (e.g. headache, runny nose, cough), stomach or intestinal flu (e.g. diarrhea, nausea), skin infections (e.g. eczema, warts, persistent acne, dandruff), bladder infections (e.g. cystitis), autoimmune diseases (e.g. allergies, asthma), or other infections (e.g. ear ache, eye infection). In addition, participants were asked to report the number of infections for which they had taken antibiotics in the past three years.

Neuroticism. Neuroticism scores were computed based on the average of 8 items from the Big Five Inventory (BFI) (John & Srivastava 1999). Scores on each item ranged from 1 (strongly disagree) to 7 (strongly agree).

Inclusion criteria

The distribution of the total days of infections is right-skewed with 17% of the participants reporting zero infections. To avoid influential outliers with a high number of reported infections, we calculated extreme Tukey's hinges (3 times the interquartile range above the third quartile) for the number of days with infections (Tukey 1977). This resulted in excluding 88 improv artists and 38 control participants with more than 188 days with infections.

All data described below excluded those participants. In addition, three improv artists and 16 control participants with BMI > 47 which represent extreme Tukey's hinges were excluded from the analysis of BMI only.

Results

All analyses were performed using SPSS version 22. Using t-tests we compared the differences between improv artists and the control group on each illness indicator. We calculated Cohen's d effect sizes for the difference scores on each of the health measures between improv artists and control (J. Cohen 1988). These results are presented in Table 1.

Insert Table 1 about here

Overall, the results show that improv artists reported having significantly more infections and more days with infections, compared to the control group. Improv artists had more infections on six of the seven categories of infectious diseases, with the only exception being bladder infections, where the control group reported slightly higher numbers. Improv artists and the control group did not differ in their BMI or in the number of times they had taken antibiotics.

To test the possible effects of sex, age and neuroticism on health outcomes, we conducted two general linear models (GLMs) with the two main illness indicators (i.e., the total number of infections and total days with infections) as dependent variables (DVs). The GLMs consist of two between-subject factors, group (0 = control, 1 = improv) and sex (0 = women, 1 = men), and three covariates (BMI, age, and neuroticism).

For the model with the total number of infections as a DV, the only variable yielding a significant main effect was group [$B = 3.46$ (S.E. = 1.59), $F(1, 1163) = 11.47$, $p < .001$]. For the model with the total number of days with infections as a DV, the results revealed two main effects: group [$B = 24.82$ (S.E. = 3.53), $F(1, 1163) = 92.87$, $p < .001$], and sex [$B = -6.68$ (S.E. = 2.52), $F(1, 1163) = 17.07$, $p < .001$]. Women reported significantly more days with infectious diseases compared to men. The interaction between group and sex was non-significant [$F(1, 1163) = 0.90$, $p > .344$].

To test whether there is any relationship between the illness indicators and the amount of experience improv artists have, correlations between the number of years and months improv artists have experience performing on stage and all illness indicators were computed among the group of improv artists only. Only the correlation with BMI was significant at $r = .171$ ($p < .001$).

Discussion

The purpose of this study was to examine whether comedy performers have better health compared to other people. In nearly all categories, the amateur improv artists group reported significantly higher incidences of infections, both in the numbers of infections and days suffering from infections, compared to a control group. When looking at individual types of illnesses, the largest differences (based on effect sizes) were found for days with respiratory infections, days with head colds, days with skin infections, and days with autoimmune diseases. These differences held even after controlling for BMI, age, and neuroticism. Improv artists and controls were also about the same age, had a similar average BMI, and used antibiotics at a similar rate.

The current study provides evidence that comedy performers may suffer from a higher prevalence of infectious diseases. It is possible that, contrary to common beliefs, humor does not have a beneficial effect on health and specifically on the immune system. However, even if this is true, it still remains to be explained why the improv artists in our study suffered from more infections. Perhaps the stress associated with the competitive and uncertain nature of a career in humor contributed to the high number of infections (S. Cohen & Williamson 1991; Glaser, Rabin, Chesney, Cohen & Natelson 1999). It is also possible that improv artists are more exposed to infectious diseases through their frequent interactions with the audience and with fellow performers. Thus, the higher rates of reported infections among improv artists may have more to do with factors other than comedy or humor.

The fact that our sample comprises comedy performers who are not well-known minimizes the possibility that their health problems are due to a lifestyle associated with being famous and wealthy. It has been suggested that entertainers such as comedians live a more intense life and are exposed to stress and other risks that could shorten their lives (Janus 1975; Janus, Bess & Janus 1978). Previous studies have shown that comedians and other performing artists die at a younger age than other artists, creative groups, and the average population, possibly due to more risky behaviors, such as smoking, drinking, and drug use (Rotton 1992; Epstein & Epstein 2013; Stewart & Thompson 2015). Likewise, people with a great sense of humor in other high stress jobs also have endured more adverse health effects. For example, in one three-year longitudinal study among Finnish police officers, those with higher scores on several sense of humor scales suffered from greater obesity, increased smoking, and greater risk factors for cardiovascular disease (Kerckanen et al. 2004). In contrast, comedy performers and

non-performers in the current study did not vary in their average BMI, suggesting that at least in respect to weight gain the two groups may share a similar lifestyle. Nonetheless, other lifestyle choices could jeopardize their long-term health. Previous research has shown that individuals with a greater sense of humor tend to be overly optimistic about their health (Kuiper & Nicholl 2004). In another study, among highly gifted children that were followed for decades, those who were rated as having a better sense of humor in childhood, smoked more and consumed more alcohol as adults, and died at an earlier age, compared to other children who were rated as having less humor (Friedman et al. 1993; L.R. Martin et al. 2002; Edwards & Martin 2012). These results suggest that, perhaps because of their generally less serious perspective, high humor individuals may view health risks less seriously and consequently engage in more risky behaviors. Thus, the larger amount of infectious diseases among the improv artists may indicate that they do not take care of themselves very well, ignore warning signs or symptoms of various diseases and generally live unhealthy lives, and do not go to the doctor to get checked as often as others.

A strength of our study is the sampling of a large number of comedy performers, including a high proportion of women. Previous research examining the longevity of stand-up comedians included only a small proportion of women, if at all (Rotton 1992; Epstein & Epstein 2013; Stewart & Thompson 2015; Stewart et al. 2016). Prior studies also focused mostly on deceased comedians, which did not allow an evaluation of the current health of the humorist. Our study, in contrast, collected information regarding existing health outcomes of living comedy performers, which also included additional information of possible confounding factors such as BMI and personality.

The current study offers little support for the view that humor has significant health benefits, and specifically to bolster the immune system, as being an improv artist was associated with higher susceptibility to infectious diseases. However, our study has several limitations. The main limitation is the observational nature of the study. There are other possible confounding factors that were not taken into account that might affect the outcome of the study. For example, it is possible that improv artists are more stressed than the average population due to the competitiveness of the field and long hours, and that increased stress is detrimental to their health. A direct measure of stress or a comparison group that has a similarly stressful lifestyle could help control for this variable. Another limitation is that we used self-reports and did not test the health of the comedy performers directly. It is possible that the prevalence of the actual health problems is different than what was reported by the participants. However, other studies on the beneficial relationship between humor and immunity that did test health directly also found weak and inconsistent evidence that humor benefits the immune system (R.A. Martin 2001; R.A. Martin 2007). It is also unclear how often the improv artists engage with humor in their daily lives. While humor is an important part of their work, it is possible that other people experience humor in social interactions just as much as the improv artists in our study. Additionally, the types of humor that are produced by comedy performers may be quite different from the everyday humor that most people engage in. The pressure to produce high quality humor on a daily basis, that will be appreciated by the audience, may add more stress to the life of the comedy performers.

An additional limitation to the study is the choice of a non-entertainer comparison group to the improv artists. Other performing artists or entertainers share a similar lifestyle with the

improv artists, which could explain many of the health-related problems that are unrelated to humor but are strongly affected by offstage way of life (see Rotton 1992). Moreover, our sample of improv artists comes from New York City and Los Angeles, the two largest cities in the United States, while the comparison groups were comprised of people across the US. Living in New York City and Los Angeles undoubtedly creates more stress than in other places, potentially contributing to additional health problems.

Future studies should compare comedy performers to other stage performers, preferably from the same city. Appropriate vocational groups may include actors, singers, musicians, and magicians. Such comparisons, alongside a sample from the general population, could account for potential confounding factors and provide a better picture of the relationship between humor and health outcomes. By including both performers and people from the general population, it would be possible to separate the unique influences of performers' lifestyle and humor on health. Additionally, to get a more complete understanding of how various humor facets affect health, daily uses of humor should also be measured, as the comedy portrayed on stage is quite different from what is used in everyday life. Lastly, more objective measures of health, such as blood samples and physical examinations, might alleviate some of the problems associated with self-report of health problems and present a more accurate picture of the relationship between humor and health.

In conclusion, in contrast to the popular belief that humor is good for one's health, our study revealed that being surrounded with humor as an integral part of one's profession is associated with higher reported health problems. It is not clear whether our results extend to other vocational humorist groups, such as stand-up comedians or comedy actors, or to ordinary

people who consume and enjoy humor daily but do not possess extreme humor abilities. More studies on diverse populations of both humor producers and appreciators that utilize varied health outcomes and with additional controls could illuminate the myriad relationships between humor and health, and when and how humor might be good for our health.

References

- Abel, Millicent H. & Maxwell, David 2002. Humor and effective consequences of a stressful task. *Journal of Social and Clinical Psychology* 21(2), 165-190.
- Anderson, Craig A. & Arnoult, Lynn H. 1989. An examination of perceived control, humor, irrational beliefs, and positive stress as moderators of the relation between negative stress and health. *Basic and Applied Social Psychology* 10(2), 101-117.
- Attardo, Salvatore 2014. *Encyclopedia of Humor Studies*. Thousand Oaks, CA: SAGE Publications.
- Cohen, Jacob 1988. *Statistical power analysis for the behavioral sciences (second edition)*. (Statistical power analysis for the behavioral sciences, Hillsdale, NJ: Routledge.
- Cohen, Sheldon & Williamson, Gail M 1991. Stress and infectious disease in humans. *Psychological bulletin* 109(1), 5-24.
- Cousins, Norman 1979. *Anatomy of an illness as perceived by the patient: reflexions on healing and regeneration*. New York: W. W. Norton and Co.
- Cousins, Norman 1985. Therapeutic value of laughter. *Integrative Psychiatry* 3(2), 112-112.
- Edwards, Kim R & Martin, Rod A 2012. Do humorous people take poorer care of their health? Associations between humor styles and substance use. *Europe's Journal of Psychology* 8(4), 523-534.
- Epstein, C. R. & Epstein, R. J. 2013. Death in The New York Times: the price of fame is a faster flame. *QJM: An International Journal of Medicine* 106(6), 517-521.
- Fisher, Seymour & Fisher, Rhoda Lee 1981. *Pretend the world is funny and forever: A psychological analysis of comedians, clowns, and actors*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Friedman, Howard S., Tucker, Joan S., Tomlinson-Keasey, Carol, Schwartz, Joseph E., Wingard, Deborah L. & Criqui, Michael H. 1993. Does childhood personality predict longevity? *Journal of Personality and Social Psychology* 65(1), 176-185.
- Fry, P. S. 1995. Perfectionism, humor, and optimism as moderators of health outcomes and determinants of coping styles of women executives. *Genetic, Social, and General Psychology Monographs* 121(2), 211-245.
- Gangestad, Steven W. & Grebe, Nicholas M. 2014. Pathogen avoidance within an integrated immune system: Multiple components with distinct costs and benefits. *Evolutionary Behavioral Sciences* 8(4), 226-234.
- Gervais, Matthew & Wilson, David Sloan 2005. The evolution and functions of laughter and humor: a synthetic approach. *The Quarterly Review of Biology* 80(4), 395-430.
- Glaser, Ronald, Rabin, Bruce, Chesney, Margaret, Cohen, Sheldon & Natelson, Benjamin 1999. Stress-induced immunomodulation: implications for infectious diseases? *Jama* 281(24), 2268-2270.
- Greengross, Gil 2014. Male production of humor produced by sexually selected psychological adaptations. In Viviana A. Weekes-Shackelford & Todd K. Shackelford (eds.), *Evolutionary perspectives on human sexual psychology and behavior*. 173-196. New York, NY US: Springer Science + Business Media.
- Greengross, Gil & Mankoff, Robert 2012. Inside "Inside Jokes": The hidden side of humor. A review of Matthew M. Hurley, Daniel C. Dennett, and Reginald B. Adams Jr., *Inside jokes: Using humor to reverse-engineer the mind*. *Evolutionary psychology: an international journal of evolutionary approaches to psychology and behavior* 10(3), 443-456.
- Greengross, Gil, Martin, Rod A. & Miller, Geoffrey F. 2012. Personality traits, intelligence, humor styles, and humor production ability of professional stand-up comedians compared to college students. *Psychology of Aesthetics, Creativity and the Arts* 6(1), 74-82.
- Greengross, Gil & Miller, Geoffrey F. 2009. The Big Five personality traits of professional comedians compared to amateur comedians, comedy writers, and college students. *Personality and Individual Differences* 47(2), 79-83.
- Greengross, Gil & Miller, Geoffrey F. 2008. Dissing oneself versus dissing rivals: Effects of status, personality, and sex on the short-term and long-term attractiveness of self-deprecating and other-deprecating humor. *Evolutionary Psychology* 6(3), 393-408.
- Hurley, Matthew, Dennett, Daniel & Adams Jr., Reginald 2011. *Inside Jokes: Using Humor to Reverse-Engineer the Mind* Cambridge, MA: The MIT Press.
- Janus, Samuel S. 1975. The Great Comedians: Personality and Other Factors. *American Journal of Psychoanalysis* 35(2), 169-174.

- Janus, Samuel S., Bess, Barbara E. & Janus, Beth R. 1978. The great comediennes: Personality and other factors. *The American Journal of Psychoanalysis* 38(4), 367-372.
- John, Oliver P & Srivastava, Sanjay 1999. The Big Five trait taxonomy: History, measurement, and theoretical perspectives. In L. A. Pervin & O. P. John (eds.), *Handbook of personality: Theory and research* 102-138. New York: Guilford Press.
- Kerkanen, Paavo, Kuiper, Nicholas A. & Martin, Rod A. 2004. Sense of humor, physical health, and well-being at work: A three-year longitudinal study of Finnish police officers. *Humor: International Journal of Humor Research* 17(1), 21-35.
- Kohler, Gabriele & Ruch, Willibald 1996. Sources of variance in current sense of humor inventories: How much substance, how much method variance? *HUMOR: International Journal of Humor Research* 9(3-4), 363-397.
- Kuiper, Nicholas A & Nicholl, Sorrel 2004. Thoughts of feeling better? Sense of humor and physical health. *Humor* 17(1/2), 37-66.
- Lahey, Benjamin B 2009. Public health significance of neuroticism. *American Psychologist* 64(4), 241-256.
- Lefcourt, Herbert M., Davidson-Katz, Karina & Kueneman, Karen 1990. Humor and immune system functioning. *HUMOR: International Journal of Humor Research* 3, 305-321.
- Long, Debra L. & Graesser, Arthur C. 1988. Wit and humor in discourse processing. *Discourse Processes* 11(1), 35-60.
- Martin, Leslie R., Friedman, Howard S., Tucker, Joan S., Tomlinson-Keasey, Carol, Criqui, Michael H. & Schwartz, Joseph E. 2002. A life course perspective on childhood cheerfulness and its relation to mortality risk. *Personality and Social Psychology Bulletin* 28(9), 1155-1165.
- Martin, Rod A. 1998. Approaches to the Sense of Humor: A Historical Review. In Willibald Ruch (ed.), *The Sense of Humor: Explorations of a Personality Characteristic* 15-60. Berlin: Walter de Gruyter.
- Martin, Rod A. 2001. Humor, Laughter, and Physical Health: Methodological issues and Research Findings. *Psychological Bulletin* 127(4), 504-519.
- Martin, Rod A. 2007. *The Psychology of Humor: An Integrative Approach*. London: Elsevier Academic Press.
- McClelland, David C. & Cheriff, Adam D. 1997. The immunoenhancing effects of humor on secretory IgA and resistance to respiratory infections. *Psychology and Health* 12(3), 329-344.
- McGhee, Paul 1996. *Health, healing, and the amuse system: Humor as survival training*. New York: Kendall/Hunt.
- McGhee, Paul 2010. *Humor: The Lighter Path to Resilience and Health*. Bloomington, IN: AuthorHouse.
- McGraw, A. Peter & Warren, Caleb 2010. Benign Violations: Making Immoral Behavior Funny *Psychological Science* 21(8), 1141-1149.
- Mobbs, Dean, Hagan, Cindy C., Azim, Eiman, Menon, Vinod & Reiss, Allan L. 2005. Personality Predicts Activity in Reward and Emotional Regions Associated with Humor. *Proceedings of the National Academy of Sciences of the United States of America* 102(45), 16502-16506.
- O'Quin, Karen & Derks, Peter 1997. Humor and Creativity: A Review of the Empirical Literature. In M. Runco (ed.), *Creativity research handbook* 223-252. Cresskill, NJ: Hampton Press.
- O'Shannon, Dan 2012. *What are you laughing at? A Comprehensive Guide to the Comedic Even*. NY, New York: Bloomsbury Academic.
- Porterfield, Albert L. 1987. Does sense of humor moderate the impact of life stress on psychological and physical well-being? *Journal of Research in Personality* 21(3), 306-317.
- Provine, Robert 2000. *Laughter: A scientific investigation*. New York: Viking.
- Rotton, James 1992. Trait humor and longevity: Do comics have the last laugh? *Health Psychology* 11(4), 262-266.
- Ruch, Willibald 2004. Humor. In C.P. Peterson & M. E. P. Seligman (eds.), *Character strengths and virtues: A handbook of classification* 583-598. Washington DC: American Psychological Association & Oxford University Press.
- Salinsky, Tom & Frances-White, Deborah 2013. *The improv handbook: the ultimate guide to improvising in comedy, theatre, and beyond*. New York, NY: Bloomsbury Methuen Drama.
- Samson, Andrea C. & Huber, Oswald 2007. The interaction of cartoonist's gender and formal features of cartoons. *Humor: International Journal of Humor Research* 20(1), 1-25.
- Simon, Jolene M. 1990. Humor and its relationship to perceived health, life satisfaction, and morale in older adults. *Issues in Mental Health Nursing* 11(1), 17-31.

- Stewart, Simon & Thompson, David R. 2015. Does comedy kill? A retrospective, longitudinal cohort, nested case–control study of humour and longevity in 53 British comedians. *International Journal of Cardiology* 180, 258-261.
- Stewart, Simon, Wiley, Joshua F, McDermott, Cressida J & Thompson, David R 2016. Is the last “man” standing in comedy the least funny? A retrospective cohort study of elite stand-up comedians versus other entertainers. *International Journal of Cardiology*.
- Thornhill, Randy & Gangestad, Steven W. 2006. Facial sexual dimorphism, developmental stability, and susceptibility to disease in men and women. *Evolution and Human Behavior* 27(2), 131-144.
- Tukey, John W 1977. *Exploratory Data Analysis*. Reading: MA: Addison-Wesley
- Watson, David & Pennebaker, James W. 1989. Health complaints, stress, and distress: Exploring the central role of negative affectivity. *Psychological Review* 96(2), 234-254.
- Weisenberg, Matisyohu, Raz, T & Hener, T 1998. The influence of film-induced mood on pain perception. *Pain* 76(3), 365-375.

Table 1

Comparisons and effect sizes between improv artists and a control group on illness indicators in previous three years

| | Improv (n=511) M (SD) | Control (n=795) M (SD) | t(df) | d |
|----------------------------------|-----------------------------|------------------------------|----------------|-------|
| BMI | 24.70 (5.21) | 24.51 (6.96) | 0.52(1144) | 0.03 |
| Respiratory Infections | | | | |
| Number | 0.96 (1.64) | 0.71 (1.77) | 2.54(1276)** | 0.15 |
| Days infected | 6.72 (13.51) | 2.52 (7.14) | 6.06(1234)*** | 0.39 |
| Head colds | | | | |
| Number | 4.26 (3.66) | 2.89 (5.41) | 4.97(1290)*** | 0.30 |
| Days infected | 15.18 (16.50) | 7.59 (12.57) | 8.70(1276)*** | 0.52 |
| Stomach or intestinal flu | | | | |
| Number | 2.05 (4.31) | 1.55 (4.11) | 2.04(1276)* | 0.12 |
| Days infected | 3.99 (6.82) | 2.69 (6.93) | 3.17(1228)** | 0.19 |
| Skin infections | | | | |
| Number | 1.70 (7.38) | 0.80 (2.48) | 2.56(1260)* | 0.16 |
| Days infected | 9.71 (23.81) | 3.19 (13.43) | 5.19(1212)*** | 0.34 |
| Bladder infections | | | | |
| Number | 0.13 (0.64) | 0.31 (1.33) | -3.19(1261)*** | -0.17 |
| Days infected | 0.61 (3.16) | 0.59 (2.60) | 0.15(1203) | 0.01 |

Autoimmune diseases

| | | | | |
|---------------|--------------|--------------|---------------|------|
| Number | 3.74 (21.01) | 1.15 (5.84) | 2.59(1255)** | 0.17 |
| Days infected | 9.40 (20.50) | 2.51 (10.60) | 6.42(1209)*** | 0.42 |

Other infections

| | | | | |
|---------------|-------------|-------------|--------------|-------|
| Number | 0.48 (1.70) | 0.49 (1.67) | -0.13(1257) | -0.01 |
| Days infected | 2.43 (8.04) | 1.29 (4.66) | 2.68(1212)** | 0.17 |

| | | | | |
|----------------------------|---------------|---------------|---------------|-------|
| Total number of infections | 12.53 (23.75) | 7.91 (13.63) | 3.99(1302)*** | 0.24 |
| Total days infected | 39.66 (41.17) | 19.09 (29.38) | 9.80(1304)*** | 0.58 |
| Number of antibiotics | 1.39 (1.94) | 2.64 (19.98) | -1.75(1252) | -0.09 |

Positive effect size denotes that improv artists scored higher than the control group on the illness indicator. Levene’s Homogeneity of Variance Test was conducted. In cases where non-equal variances were discovered non-pooled error terms were used. d denotes Cohen’s effect size (Cohen 1988).

* P < 0.05.

** P < 0.01.

*** P < 0.001.