Web-only Appendix

Tobacco use in popular movies during the past decade

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This appendix is in depth review of the literature on trends in tobacco depictions in films, an explanation of research methods used, and research findings not reported in the published article.

Literature on smoking prevalence in films

Despite many studies on this topic, whether tobacco use in popular films has increased, decreased or stayed the same over this and past decades is debated. Studies using data from films released before the 1990's show weak or indiscernible trends. [1.2.4] Specifically while one study found that rates were increasing at the end of the 1990's[1] two studies found neither and increase or decrease in smoking in the decades preceding the 1990's. [2,4] Studies that assess trends in the 1990's are even more inconsistent. [3,5,6, 7,8,9,10]

Inconsistent findings for trends of tobacco depictions in films are linked with methodologies used as well as with actual movie content analyzed. Sample size, the study time frame, how data were collected and coded, and how data were analyzed influence findings reported. The following chart shows 9 published studies that report trends in rates of smoking in movies over time. Sample, timeframe, measures, coding, analysis and findings are briefly described. Additionally the methodological rigor of each of these study components is ranked positively (+) or negatively (-).

Table 1 : Summary of studies on trends of smoking in popular films

Study	Sample	Time	Measure	Coding	Analysis	Findings
1. Terre,	20 top	1977-	5 minute	Two	ANOVA/ F	High late

Drabman Speer, 1991	DBO* per year +	1988 +	intervals of smoking events +	coders per film/ inter-rater reliablity +	values but data analysis poorly described + -	70's /Dipped mid 80's/ increase late 80's
2. Russo-Hazan, Liptons, Glantz, 1994	2 films per year randomly selected from top DBO -	1960-1990 +	5 minute intervals of smoking events +	Not described -	Chi squares / data not analyzed according to level of measurement used -	No change in rate of smoking in films
3. Stockwell, Glantz, 1997	5 films per year randomly selected from top DBO -	1990-1996 -	5 minute intervals of smoking events +	One coder per film -	Chi squares/data not analyzed according to level of measurement used -	Smoking in films is increasing
4. McIntosh Bazzini, Smith Wayne, 1998	20 films per decade randomly selected from 20 top DBO per year = 10% sample(n = 100 films) Per decade sample size too small (n= 20) for comparative statistical analysis -	1940-1989 +	Number actors smoking -	Three raters per film/ High inter-rater reliability reported +	No clearcut statistical analysis despite percentage of smokers declining by more than half between 1950's and 1980's -	No systematic trend: increase 1950's (31%) / decrease 1980's (12%)
5. Everett, Schnuth, Tribble, 1998.	10 top DBO* per year	1985 – 1995	5 minute intervals of smoking events	Two raters per film	Spearman rho coefficients assess relationship between year of film and proportion	No change in rate of smoking in films

	+	+	+	+	pro-smoking, anti-smoking events +	
6. Dalton Tickle, Sargent Beach Ahrens Heatherton, 2002	25 films per year +	1988-1997 +	Tobacco exposure time +	Two coders per film +	Descriptive statistics, t-tests, data transformed +	No change in rate of smoking in films
7. Kacirk, Glantz, 2001	5 films per year randomly selected from top DBO -	1960-2000 +	5 minute intervals of smoking events +	Not described -	Regression analysis used but explanation of statistical methods unclear -	Smoking in films is increasing
8. Ng, Drakake 2002	Top 10 PG-13 films per year -	1996-1999 -	Length of tobacco use in minutes +	Not described -	Compare simple averages rather than use a statistic/ no trans-formation of skewed data/ data analysis incorrect -	Smoking in films is increasing
9. Glantz, Kacirk, McCulloch, 2004	2 films per year 1950-59/5 films per year 1960-2002, randomly selected from top DBO -	1950-2002 +	5 minute intervals of smoking events +	One coder per film -	Non parametric method / no data transformations/ questionable treatment of outliers -	Smoking in films is increasing

*DBO Domestic Box Office

While most studies reviewed used valid measurement strategies and considered rating of the films selected,[1,3,5,7,8] a number of deficiencies were found. Small sample sizes lower study external validity and limit statistical analyses, [2,3,7,9] while short time frames make trend analysis questionable. [3,8] With one exception [7] none of the studies made corrections or power transformations for non normally distributed or asymmetric data. Statistical methods used in some studies were not well explained,[1,7,9] and in some cases were incorrect. [8] For example, one study that claimed that smoking rates in the PG-13 movies doubled between 1996 and 1999 collected data which appear to be valid, but then through a faulty statistical treatment invalidated the study findings. Positively skewed annual distributions in this study were not transformed to correct for non normality in the data set and simple averages rather than a statistic such as a t-test or ANOVA were used to compare annual distributions. When the data were re-analyzed with these adjustments no significant differences in smoking rates were found in the time frame observed. In another study not only were sample sizes very small per year considered, but rather than transforming data, outliers were discarded without sufficient explication or rationale to assure the statistical validity of procedures used. [9]

It should be noted that those studies which had the strongest methodologies found no increase in smoking in the early to mid 1990s compared to the 1980s,[5,6] while those studies with the weakest methods report an increase in the 1990s. [3,7,8,9]

Methodological Considerations

Dependent variables for this analysis are total number of tobacco incidents in films observed, or tobacco incidents per minute defined as total incidents of tobacco use divided by length of film in minutes. Tobacco incidents are counted as smoking events in

a frame while a frame is defined as the duration the camera is focused on a particular person, object, or action. Incidents are any incident of cigarettes, cigars and chewing tobacco in films, or depictions of smoking paraphernalia such as cigarette packs, ashtrays, or brand name advertisements. Thus when the camera goes to another frame, if there is smoking in that frame, even by same person, it is considered another smoking incident. However within one frame there can be multiple persons smoking: these are considered multiple incidents.

All movies were reviewed in video format for accuracy and ease of confirmation of coded content. Initial content coders for the Thumbs Up! Thumbs Down! data base were youth volunteers aged 14 - 22, who were recruited annually, trained extensively on coding films and filling out the review forms.[10] To assure accuracy, each movie was viewed in its entirety and coded by three reviewers. If inter-rater reliability rates indicated substantial disagreement on the number of incidents or characteristics of incidents a fourth review was carried out either by TUTD staff or a veteran youth reviewer. Concordance coding, where there is agreement between coders, was used to determine final codes entered for all films in the sample.

For the phenomenon studied, tobacco use in films considered on an annual basis, distributions are skewed as most films released have low or no smoking while a few films may have much higher rates than average. Distribution of the original variable tobacco use per minute of film is positively skewed with skewness of 1.7. For a standard normal distribution, the skewness should be close to zero. The kurtosis of the distribution is 2.8. For a standard normal distribution, the kurtosis should be close to 3. For this type of distribution non transformed mean scores are poor indicators of central tendency, and

outcomes based on these scores tend to be biased upward. Therefore prior to multivariate analyses, power transformations of dependent variables of total incidents of tobacco use and tobacco use incidents per minute of films were carried out using square root transformations. Specifically the standard practice is to transform a positively skewed distribution using the descending ladder of powers from taking square root to the Log X. [11] Thus we transformed the values of smoking minutes per film by the square root of each value which improved the normality distribution thus allowing utilization of standard statistical analyses.

After the transformation we also tested for the assumption of homoscedasticity or constant error variance for the transformed variable tobacco use per minute. Results for the Breusch-Pagan/ Cook-Weisberg test for heteroscedasticity, the coefficeints transformed back to per minute coefficients, were chi2(1) = 1.14; Prob > chi2 = 0.2859 , which implies that the constant error variance assumption holds. Q-q plots are shown before and after the transformation of this variable and show deviation from normality (Figure 1) and then the normalized scale after transformation (Figure 2). These tests show that this measure meets assumptions for use in General Linear Models and regression methods used.

Figure 1

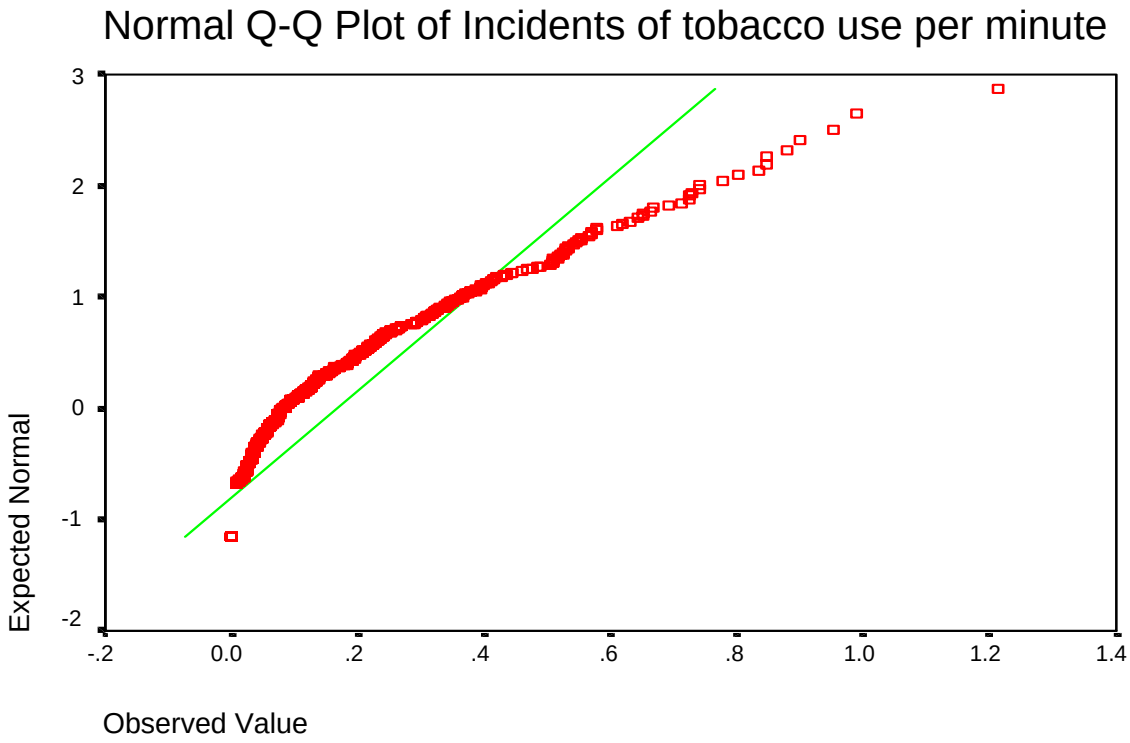
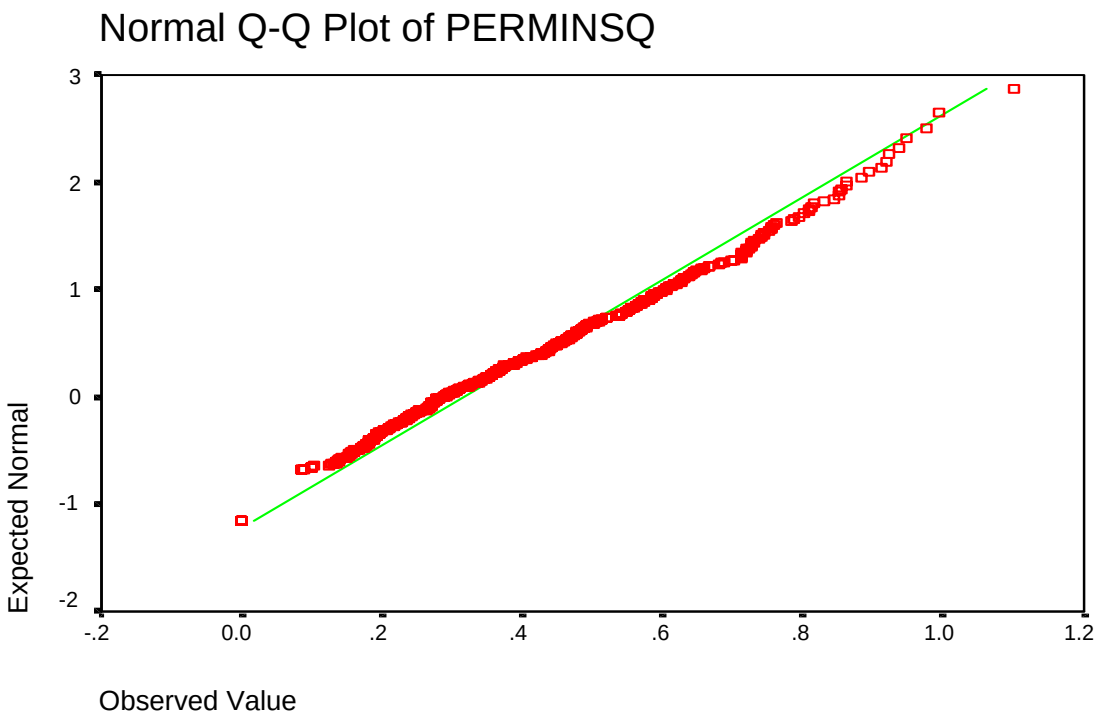


Figure 2



Findings

Based on Motion Picture Academy of American (MPAA) rankings, only 26 films (5.3%) reviewed were rated 'G'. Ninety-two films (18.5%) were rated 'PG', 170 films (34.3%) were rated 'PG-13', and 208 films (41.9%) were rated R. Most films were either action adventure (153, 30.8%), comedy (32, 26.6%,or drama (85, 17.1%) with the remaining 25 percent classified as family, horror, science fiction or mystery

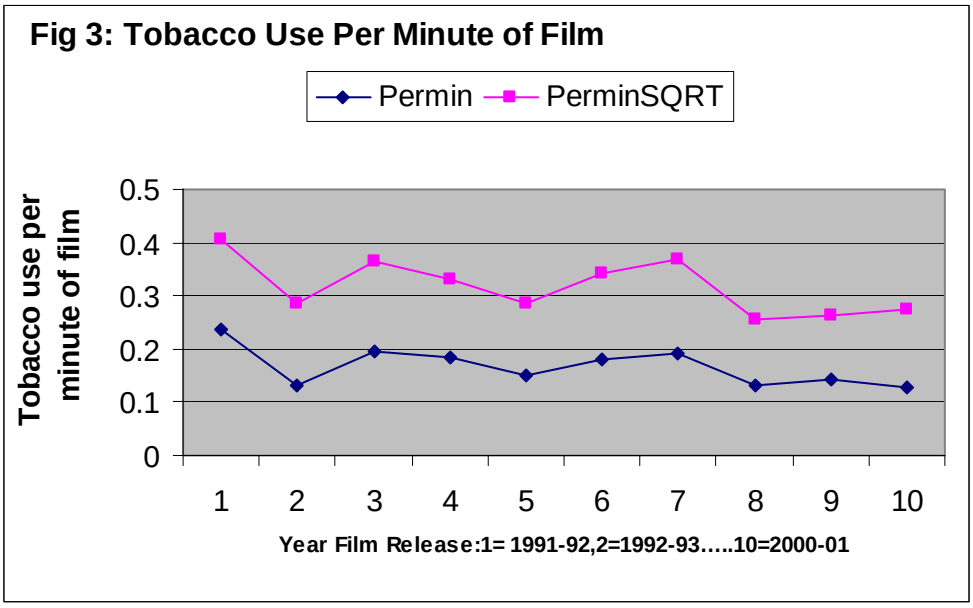
Figure 3 shows the number of smoking events per minute of film, the upper rate indicating the square root value. Table 2 is the General Linear Models analysis with tobacco use per minute of film as the dependent variable.

Table 2: General Linear Model: Main and Interaction Effects: Dependent Variable Tobacco Use Per Minute of Film (PERMINSQRT)

	Model: Between Subjects			
Source of Variance	**Sum of Sqares**	**df**	**Mean Square**	**F**
Corrected model(1)	14.214	137	0.104	1.959***
Intercept	6.911	1	6.911	130.513***
Rating	0.613	3	0.204	3.858**
Genre	0.33	6	5.15E-02	1.04
Year of Release	1.278	9	0.142	2.681**
Rating X Genre	0.555	11	5.05E-02	0.953
Rating X Year of Release	1.805	26	6.94E-02	1.311
Genre X Year of Release	3.437	45	7.64E-02	1.442*
Rating X Genre X Year of Release	1.805	37	4.88E-02	0.921
Error	18.905	357	5.30E-02	
Total	83.36	495		
Corrected Total	33.119	494		

p < .05, **p < .01, *** p < .001

Model: R Squared = .429 (Adjusted R- squared = .210)



The estimates of change in smoking over the ten year period are based on the Mixed Methods Regression analysis findings and indicate the expected change in smoking per minute associated with a unit change in our independent variable X. Overall the rate of change is -.011 x 90 or .99 minutes per movie for a ninety minute movie. For youth oriented movies the rate change is based on -.014 x 90 = 1.26 minutes per movie for a ninety minute movie. This means that over the decade reviewed there was one fewer smoking scene on average per year and for PG -13 this rate was 1.26 fewer scenes per year on average.

Discussion

This study showed that in the time frame of the study 1991 – 2000, a very high fluctuation in smoking in films from year to year in the early part of the decade flattened out by the end of the decade, and then rates started to decline. This finding contradicts a number of other studies on the topic that have reported that rates of tobacco use in films ahs been increasing during the 1990's. There are many reasons why some studies might report that tobacco use in films is increasing or is higher in the last decade, especially if there are differences in the time frame of the study or differences in sampling techniques. If fewer films are selected, as higher grossing films tend to be R and PG- 13 ratings, they have higher rates of tobacco use both in regards to frequency and overall use. Our study shows that rates in r-rated films are increasing. A larger sample includes more G and PG films where rates of tobacco use have generally been low in the decade studied. PG -13 films also showed a decrease with the exception of dramas classified as PG-13, where tobacco rates went up.

Recent findings reported by the American Lung Association Sacramento Emigrant Trials, the organization that has sponsored the Thumbs Up! Thumbs Down! data set since 1991, indicate that in Years 2001 – 2003, the overall rate of smoking in films has edged up slightly over the previous three years.[10] However they do report that For PG-13 films the actual rates of tobacco use per minute did not change, but increased production of PG-13 films at present may increase youth exposure to tobacco depictions. As these rates fluctuate from year to year it is premature to suggest that tobacco use in the movies is on the upswing. These more recent rates are not equal to the higher rates of tobacco use found in films released in 1990 through 1993.

While this study is important for advocacy work in regards to reducing tobacco use on the screen, data presented are not sufficient to model youth exposure rates either real or potential to tobacco depictions on screen. To do that one would need to conduct cross sectional research with youth audiences to monitor what they watch and how that impacts behavior. [12, 13]

Cinema today is a high volume, high impact enterprise. Hundreds of films are produced per year with only a percentage going into general release or staying in release long enough to be seen by large numbers of persons. A strength of the current study is a larger sample than previous studies which allows more statistical power and more precise estimates. Compared to previous studies findings reflect more truly what industry norms are as regards smoking in films. However we realize that even this sample may be deficient as it only those films that attained some commercial success are sampled. More data and further analyses will allow expansion of these models. Of importance is the continuation of data collection efforts that allow for sufficient sample size and high

quality measures that enable accurate analysis of trends. Support of media surveillance methods enable public health advocates to make informed observations about the state of popular entertainment. In the case of tobacco depictions in films, given their role in influencing youth smoking, it is important rates continue to decline, and efforts made to induce celebrities to reduce their on screen smoking. Whether this is done through continued advocacy to raise consciousness among persons in the entertainment community to voluntarily reduce depictions, or through policies adopted by the entertainment community to limit tobacco use in films, such as a revised MPAA rating, remains to be seen.[14-17] Both methods could have the beneficial effect of reducing tobacco use on screen which in turn might help to reduce tobacco use among the most vulnerable film viewers, children and adolescents both in the US and abroad.

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