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Use of humor in medical education: a survey of students and teachers at a medical school in China

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Use of humor in medical education: a survey of students and teachers at a medical school in China

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Running title: Humor in medical education

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Strengths and limitations of this study

- This is the first questionnaire survey of medical students and physician teachers regarding using of humor in medical education.
- The study provides useful information of medical student and teacher's opinions on using humor in the classroom and identifies appropriate and inappropriate humor behaviors.
- The main limitation of this study was that it is a single center study on a relatively small study population and with limited scope.

ABSTRACT

Objective: Humor is a powerful resource in medical education; however, little is known about what students and teachers think about its use and even less about which challenges teachers face in using humor and how they address them, which are the subject of the present study.

Design: Separate cross-sectional questionnaire surveys.

Setting: Tongji Medical College and Tongji Hospital in China.

Participants: 327 students at Tongji Medical College and 165 physician teachers at Tongji Hospital in China.

Main outcome measures: The primary study outcome was assessed by proporation.

Results: Eight-five percent of student and teacher respondents agreed with using humor in the didactic setting, and felt it fostered a positive didactic atmosphere. An interesting clinical case was the most frequently used humor type by teachers and considered the most effective by students. Lack of humorous materials related to the lecture subject and failure at being humorous were the main challenges to humor use cited by teachers. Collecting humorous materials in their daily work and life, observing teachers with a reputation for successfully using humor, and efficiently using the internet enhanced humor use ability.

Conclusion: The present study confirms that most medical students and physician teachers support the use of humor in medical didactics, with particular strategies aiding its use and positive impact.

Keywords: Humor, Student, Physician instructor, Medical education

INTRODUCTION

Acquiring basic clinical skills is the primary mission of medical students.[1] Historically, education has been considered as a solemn endeavor, and using humor in the learning process has not been valued or encouraged. In recent years, there has been a shift in societal attitudes toward the adoption of a more relaxed learning environment and an increased emphasis on making learning more enjoyable.[2-6]

Humor can affect important psychological, physiological, and immunological functions by humanizing, encouraging, defusing, illustrating, and reducing anxiety, pain, depression, and stress.[7-9] McCoy conducted phenomenon featuring interview 108 first year medical students, the study indicate that humor can foster engagement through demonstrating interest in the activities.[10] It has been found that students might be more motivated to learn and get involved in a positive classroom atmosphere .[2 11-13] Several studies have examined how humor can help students to reduce stress and anxiety, promote creativity, increase motivation, improve coping with difficulty, and more quickly access and assimilate knowledge.[3 12 14-16] Informal observation suggests that the use of humor is widespread in medical education. At the Sydney Children's Hospital, almost 80% of physicians used humor in their teaching sessions, and regularly elicited laughter from their students.[17]

Although widely practiced, there is limited research attesting to the value of humor in medical teaching. The existing research suggests that medical students can benefit from appropriate use of humor.[11] Naftulin found a positive relationship with

reported student enjoyment, Ware and Ziv noted improvement in students' test performance.[15 18 19] While some forms of inappropriate humor with discriminatory or aggressively will degrade or hurt students. Humor related to one's misfortunes or mistake may put listeners down and discouraged their enthusiasm to get involvement.[20-23] In order to maximize the benefits of humor and reduce the harm, we need to be effective and use humor model to seek a balance in appropriate humor in medical teaching.

Fewer studies have used feedback from physicians compared to students' different opinion. Sutkin notes that a good medical teacher are those who have the characteristics of valuing the feedback both from students and themselves.[24] In addition，there is scant literature on the difficulties and challenges for humor teaching. Further research on humor use in the medical school setting might help medical teachers to identify and prepare useful forms of humor for teaching, and might provide other benefits on teaching style, method and content.

The purpose of this study therefore was to assess and compare both opinions of medical students and teachers about using humor and what would influences the teacher's use of humor in medical education.

METHODS

Study design

The study used a multiple-choice questionnaire to do the research. Both quantitative and qualitative inquiries were adopted.

Participants' population and sample

The present study was conducted at Tongji Medical College and Tongji Hospital (Huazhong University of Science and Technology, Wuhan City, Hubei Province, China) from November 2014 to June 2015. Under the approval of the college research and ethics committee, a cross-sectional study was conducted among medical undergraduates at Tongji Medical College and physicians at Tongji Hospital.

A total of 327 students and 165 physicians responded to the questionnaire and signed a written informed consent. Participant characteristics are summarized in Additional Tables 1 and 2.

Survey questionnaire

The questionnaires used for data collection integrated items derived from a literature review and data analysis with distinctive questions for students and physicians. The student questionnaire comprised 8 questions related to attitudes toward the use of humor in the classroom. Each question was discussed with the respondent and included:

- Do you agree with using humor in medical teaching?
- What are the benefits of using humor in medical teaching?

- What is the proportion of the medical curriculum during which you felt bored?
- How many times of humor do you think is appropriate in a 45-minute course (each class period is 45 minutes in Tongji Medical College)?
- Which forms of humor did teachers use in past medical courses?
- Which do you consider is the most effective form of humor, and please rank them using a 9-point Likert scale ranging from most effective (9-points) to least effective (1-point).
- What do you think constitutes inappropriate humor during teaching?
- Which disadvantages do you think inappropriate humor may have during teaching?

Similarly, a survey was conducted among physicians. The physician questionnaire comprised 8 questions to investigate not only the aforementioned questions, but also difficulties in using humor and how to address them, such as,

- What is the motivation to use humor?
- Which difficulty do you face when using humor in teaching?
- Which of the following options can help to use humor during teaching?

In the same questionnaire, data were also collected on their medical discipline, gender, academic rank, age, and teaching experience in years.

Statistical analysis

The data collected were tabulated in Microsoft Excel 2014, and frequency and percentages were calculated for quantitative variables.

RESULTS

Demographic data of participants

Three hundred twenty-seven medical students (96% response rate) at the Tongji Medical College responded to the questionnaire. As shown in Additional Table 1, 52% of respondents were female, with 53% aged 17 to 20 years old and 47% aged 21 to 25 years old. The proportion of students in each year (First to Fifth) was 11%, 19%, 29%, 26% and 15%, respectively.

A total of 165 physicians at Tongji Hospital responded to the questionnaire (91% response rate): 56% of respondents were male, with age ranging from 26 to 81 years, and academic rank distributed as follows: 22% Professors, 50% Associate Professors and 28% Assistant Professors. Teaching experience ranged from 1 to 35 years; 27% with 1–9 years, 35% with 10–19 years, and 38% with 20 years or more (Additional Table 2).

Opinions of medical students and teachers on humor teaching

In the present study, 87% students felt that over 40% of the class was bored (Table 1). Among students, 45% strongly agreed and 42% agreed with using of humor in medical teaching, while the corresponding percentages for teachers were 52% and 35%, respectively (Table 2). The majority of students agreed that humor could be used to: create a relaxed classroom atmosphere (94%); make the learning experience more positive and enjoyable (90%); help student-teacher interaction by improving rapport (82%); focus students' attention on the theme (67%); and better remember more information over time (64%). As for teachers, the approval rate for the items above was 82%, 80%, 77%, 74%, and 55%, respectively. Most students emphasized that

humor worked best in a small amount: two (19%), three (36%) or four (21%) humorous remarks per 45-minute session. Most teachers used two (38%) or three (31%) humorous remarks per 45-minute session, while 12% used four. In terms of the humor type used by teachers in past courses, physicians mentioned: interesting clinical cases (70%); spontaneous, ad lib humor (67%); cartoons or videos (21%); skits (17%); questions or multiple choice items (13%); planned, non-spontaneous humor (12%); network catchwords (11%); opening jokes (7%) and quotations or analogies (2%) (Table 2). One area of significance in this study is how students evaluated the effectiveness of each humor type (Table 3). In this study, interesting clinical case was ranked highest (mean 8 ± 0.05), followed by spontaneous, ad lib humor (mean 7 ± 0.08), cartoons or videos (mean 7 ± 0.08), and planned, non-spontaneous humor (mean 6 ± 0.08).

As for the potential disadvantage of using inappropriate humor in medical teaching, humor related to sarcasm and mockery received low evaluations from the students (61% and 60% disapproval rate, respectively). Students emphasized that inappropriate humor might: spend time on an irrelevant subject (56%); distract their attention (35%); disrupt the solemn atmosphere (13%); and cannot help improve classroom performance (12%) (Table 4).

Influencing factor of humor teaching application

As is shown in Table 5, the main motivation for teachers to use humor was to foster a relaxed classroom atmosphere (63%). Self-satisfaction (38%) and a sense of joviality brought on by students' laughter (35%) also were considered as helpful to

inspire teachers to use humor during class. Teachers reported a variety of difficulties when using of humor in teaching, including: lack of humor related to course material (42%); humor did not reach the expected effect (32%); depression or frustration when humor falls flat (26%); and preparing humor is quite time-consuming (14%). Teachers affirmed that using humor in the classroom is influenced by lack of skills and scarcity of time, and that the latter could be addressed by medical college provided professional training, classroom observations, collect humorous materials in daily work or life and efficiently using the internet. Teachers reported that collecting humorous materials in daily work and life in advance (70%); making full use of network resource (29%); classroom observations of teachers with a reputation for using humor (24%); preparing the teaching content in advance (21%); reading books and articles about humor (11%); learn from teachers with reputation for humor teaching (8%); and professional training provided by medical college (4%) could improve their ability of using humor in the classroom.

DISCUSSION

In a teaching hospital, physicians usually serve the dual role of clinician and teacher with subject matter expertise and strong interest in student development. Ernest Leroy stated that: "a poor surgeon hurts 1 person at a time but a poor teacher hurts 130".[3 17] While effective teaching in medicine is essential to produce good quality doctors.[25] Almost none of the physician teachers have professional training on how to teach or pass on knowledge effectively much less teaching with humor. It has been established that the uses of humor in medical education improves learning enthusiasm, consciousness, efficiency and quality.[15, 26, 27] Few studies thus far have been conducted on the perspectives of medical students and teachers on using humor in the classroom and what influences the use of humor in medical teaching. This study attempted to identify the attitude toward using humor in teaching and how to effectively use humor during class.

There is general agreement that theoretical lectures tend to be boring.[28] In the present study, 53% of students felt that more than half their classes were boring, with nearly 80% of classes overall being considered boring. Similar findings have been reported by UCLA's Higher Education Research Institute, with 35.6% of freshman students and 37% of seniors reporting being frequently bored in class.[2 14 17] There are strategies like planning the course, conducting activities that appeal to all learning styles, creating a classroom with active participation of students, combining open-ended tasks and those with well-defined goals could help to improve the classroom environment. Cohen documented a high correlation between

teaching efficiency and students' interest, with students becoming more attentive if humor was used in teaching, consistent with the current prevailing belief. [29 30]

In the present study, over 85 percent of students and teachers agreed with using humor in the classroom. Similarly, in a study by Torok, McMorris and Lin, only 2 percent of students did not believe in the usefulness of humor in classrooms.[11] The students in the present study asserted that the use of humor created a relaxed classroom atmosphere (94%), made learning attractive and enjoyable (90%), established good rapport between students and teachers (82%), focus students' attention on the theme (67%), and enhanced learning effectiveness (64%). Consistent with these students, the doctors' approval rate of the items above was 82%, 80%, 77%, 74%, and 55%, respectively. According to teachers in the present study, humor use would be associated with positive feedback because of provision of a relaxed classroom atmosphere (63%); obtaining self-satisfaction as an teacher (38%) and fostering joviality brought on by students' laughter (35%) were the main motivations to use humor in teaching. Teachers appeared to use humor in a variety of ways including the use of interesting clinical cases (70%); spontaneous, ad lib humor (67%); cartoons or videos (21%); skits (17%); questions or multiple choice items (13%); planned, non-spontaneous humor (12%); network catchwords (11%); opening jokes (7%) and quotations or analogies (2%). Interesting clinical case was noted to be the most effective humor type, followed by spontaneous, ad lib humor, and cartoons or videos, among those with the highest ratings.

It's quite amazing that interesting clinical case was noted to be the most popular

type of humor both among teachers and students. There are different approaches to improving classroom environment by interesting clinical cases, including unusual case, detour that the mistake the doctor made during the process of diagnosing disease, the origin of medical terminology etc. For example, physician could deepen the knowledge of asymptomatic carrier through the story of Mary Mallon who infected seven families in 1906 with the typhoid, and impress students the conception of anatomical term Achilles through its derivation from the Greek god of war during the Trojan War.

Distinguishing what is appropriate and inappropriate humor in an educational culture is essential to become a qualified teacher.[31] According to Wanzer and Sarah's approach to humor teaching, inappropriate humor conveying aggressive/hostile or sexual messages would be considered inappropriate by students.[3] [11] Jayasuriya-Illesinghe stated that negative interactions with teachers will harass students.[32] This is similar to the findings of Vimmi, he found students feel embarrassing and wish to never have a class with these consultants who always say sexually offensive or sarcasm jokes again.[33] Consist with previous study, our study shows that more than 60% of students opposed mockery and sarcasm. For example, laughing at patients or students' ignorance on disease was both considered to be inappropriate.

However, additional research by Chiarello and Kaplan advocated the positive effects of laughter to remembering content.[26] [34] In the present study, 64% of students

held that they remember more information over time when humor is used in the classroom. The importance of using humor that is associated with topic taught is stressed by Brito and Chauvet.[8 16] Our study also found that most students emphasized that humor should contribute to the topic; on the other hand, humor which is irrelevant to the subject might be a waste of time, distract their attention, and cannot help to improve the classroom performance.

Humor in the classroom could be divided into two categories: high risk and low risk.[17] Spontaneous ad lib humor is a high risk type of humor because it is most likely to fail to elicit laughter, and teachers might feel depressed or frustrated when the humor falls flat.[17] Even worse, spontaneous, ad-lib humor unrelated to the subject may be distracting. Ziegler listed seven examples of basic types of low risk humor: planned ad-lib that are not spontaneous, cartoons, quotations and questions, top 10 lists, multiple-choice items, skits or dramatizations, and anecdotes.[17] Except for much higher chance to get laugh, elaborately planned ad-lib could also focus on the subject and avoid distraction. However, in the present study, spontaneous ad lib humor is the second most frequently used type of humor by teachers and also the second most effective type ranked by students. In a word, teachers prefer to use spontaneous ad-lib rather than planned ad-lib; moreover, students felt planned ad-lib was acceptable.

Previous studies had primarily focused either on the attitude toward humor education or describing the range of humor type, not on the difficulties and challenges that physicians may face during teaching. Teachers in this study were asked to identify the type of challenges they may face while transmitting a humorous message;

lacking appropriate humor material related to clinical skills (course material) was ranked at the top (42%), followed by humor failing to reach the expected effect (32%) and depression or frustration when humor falls flat (26%), and time consumed preparing humor (14%). Several studies have attempted to address these challenges. Hueppchen stated that most of the medical faculty learns to teach by observing their mentors or their teachers.[35] Furthermore, in the present study, among the solutions that physicians considered appropriate to address these difficulties were collecting humorous materials in daily work and life in advance (70%), making full use of network resources (29%), classroom observations of teachers with a reputation for using humor (24%), preparing the teaching content in advance (21%), reading books and articles about humor (11%); learn from teachers with a reputation for teaching (8%) and professional training provided by medical college (4%), the latter could be beneficial to become a competent communicator.

Limitations

While the present study provides insight into the use of humor in medical education, it has some limitations. Firstly, it is a single center study on a relatively small study population and with limited scope. Secondly, teachers and students may have different understanding about humor. Further studies are needed to explore the correlation of what teachers thought was funny and what students thought was funny.

CONCLUSION

The present study extends our knowledge of medical student and teacher's opinions on using humor in the classroom and identifies appropriate and inappropriate humor behaviors. By sharing ideas, perspectives, and benefits related to using humor in the classroom, the findings of this study might be of benefit to assist medical teachers in using humor appropriately to successfully establish good rapport with students in lectures and other teaching venues.

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Contributors XQQ and LS designed the study and the questionnaire and drafted the paper. YPL participated in data gathering, analysis and interpretation. XFW and YY implemented the study and helped some of the data analysis. HLZ and CTZ took part in the discussion and modification of the design and the questionnaire. All authors have seen and agreed to the submission of the final manuscript.

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Table 1 The attitude toward medical curriculum

Variables	Students(n=327) (%Yes)
How often have you felt bored during the medical curriculum?	
A. Always (100%)	2
B. Usually (80%)	15
C. Often (60%)	36
D. Sometimes (40%)	34
E. Seldom (20%)	10
F. Rarely (10%)	3
G. Never (0%)	0

Table 2 The attitude toward humor compared between physicians and students

Variables	Physicians (n=165) (% Yes)	Students (n=327) (% Yes)
Do you agree with using of humor in medical teaching?		
A. Strongly agree	52	45
B. Agree	35	42
C. Neutral	13	11
D. Disagree	0	2
E. Strongly disagree	0	0
What are the benefits of using humor in medical teaching?		
A. Create a relaxed classroom atmosphere	82	94
B. Make learning experience more positive and enjoyable	80	90
C. Help student-instructor interaction by improving rapport	77	82
D. Focus students' attention on the theme	74	67
E. Remembering more information over time	55	64
How many times of humor do you think are appropriate during a 45-minute course?		
A. 1	5	4
B. 2	38	19

C. 3	31	36
D. 4	12	21
E. 5	9	14
F. >5	5	6
Which form of humor have physicians used in teaching?		
A. Interesting clinical cases	70	89
B. Spontaneous, ad lib humor	67	67
C. Cartoons or videos	21	27
D. Skits	17	39
E. Questions or multiple choice items	13	18
F. Planned, non-spontaneous humor	12	20
G. Network catchwords	11	13
H. Opening jokes	7	29
I. Quotations or analogies	2	17

Table 3 Score of humor types students considered

Variables	Students (n=327) (%Yes)
Which do you consider to be the most effective form of humor? Please rank from most to least effective. (mean ± SEM)	
A. Interesting clinical cases	8±0.05
B. Spontaneous, ad lib humor	7±0.08
C. Cartoons or videos	7±0.08
D. Planned, non-spontaneous humor	6±0.08
E. Opening jokes	5±0.09
F. Questions or multiple choice items	5±0.09
G. Network catchwords	3±0.08
H. Skits	2±0.07
I. Quotations or analogies	2±0.06

Table 4 The appropriate or inappropriate type of humor

Variables	Students(n=327) (%Yes)
What do you think constitutes inappropriate humor during teaching?	
A.Sarcasm	61
B.Mockery	60
C.Humor irrelevant to the course material	34
D.Instructor appearing as performer	30
E.Ridicule	15
Which disadvantages do you think inappropriate humor may have during teaching?	
A. Spend time on an irrelevant subject	56
B. Distracts attention	35
C. Disrupts solemn atmosphere	13
D. Cannot help improve classroom performance	12

Table 5 Influencing factor of humor teaching application

Variables	Physicians (n=165) (% Yes)
How often do you use humor in medical teaching?	
A. Always (100%)	2
B. Usually (80%)	8
C. Often (60%)	13
D. Sometimes (40%)	51
E. Seldom (20%)	16
F. Rarely (10%)	9
G. Never (0%)	1
What is the motivation to use humor?	
A. To foster a relaxed classroom atmosphere	63
B. To obtain self-satisfaction as an instructor	38
C. To foster joviality brought on by students' laughter	35
D. To get positive feedback during instructor evaluation	6
Which difficulty do you face when using humor in teaching?	
A. Lack of appropriate humor related to course material	42
B. Humor did not reach the expected effect	32
C. Depression or frustration when humor falls flat	26
D. Time-consuming	14
Which of the following options can help to use humor during teaching?	
A. Collecting humorous materials during daily work and life	70
B. Making full use of network resources	29

C. Classroom observation of teachers with a reputation of using humor	24
D. Preparing the teaching content in advance	21
E. Reading books and articles about humor	11
F. Learn from instructors with a reputation for teaching using humor	8
G. Professional training provided by medical college	4

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Strengths and limitations of this study

- This is the first questionnaire survey of medical students and physician teachers regarding using of humor in medical education.
- The study provides useful information of medical student and teacher's opinions on using humor in the theoretical lecture and identifies appropriate and inappropriate humor behaviors.
- The main limitation of this study is that it is a single center study on a relatively small study population.

ABSTRACT

Objective: Humor is a powerful resource in medical education. The purpose of this study is to investigate what students and teachers think about the use of humor. What challenges do teachers face in using humor and how they address them are also the subject of the present study.

Design: Separate cross-sectional questionnaire surveys.

Setting: Tongji Medical College and Tongji Hospital in China.

Participants: 327 students at Tongji Medical College and 165 physician teachers at Tongji Hospital in China.

Main outcome measures: The primary study outcome was assessed by proporation.

Results: Eighty-seven percent of student and teacher respondents agreed with using humor in the didactic setting. They felt humor fostered a positive didactic atmosphere. Interesting clinical case was the most frequently used humor type by teachers and considered the most effective by students. Lack of humorous materials related to the lecture subject was the main challenge to humor use cited by teachers. Collecting humorous materials in teacher's daily work and life, observing teachers with a reputation for successfully using humor, and efficiently using the internet enhanced humor use ability.

Conclusion: The present study confirms that most medical students and physician teachers support the use of humor in medical didactics, with particular strategies aiding its use and positive impact.

Keywords: Humor, Medical student, Physician teacher, Medical education

INTRODUCTION

Acquiring basic clinical skills is the primary mission of medical students.[1] Historically, education has been considered as a solemn endeavor, and using humor in the learning process has not been valued or encouraged. In recent years, there has been a shift in societal attitudes toward the adoption of a more relaxed learning environment and an increased emphasis on making learning more enjoyable.[2-6]

Humor can affect psychological, physiological, and immunological functions by humanizing, encouraging, defusing, illustrating, and reducing anxiety.[7-9] McCoy interviewed 108 first year medical students, the result of the study indicated that humor could foster engagement through demonstrating interest in the activities.[10] It has been found that students might be more motivated to learn and get involved in a positive classroom atmosphere.[2 11-13] Several studies have examined how humor can help students to reduce stress, promote creativity, increase motivation, and assimilate knowledge more quickly.[3 12 14-16] Informal observation suggests that the use of humor is widespread in medical education. At the Sydney Children's Hospital, almost 80% of physicians used humor in their teaching sessions, and regularly elicited laughter from their students.[17]

A positive relationship was found between humor and students' test performance.[15 18 19] While some forms of inappropriate humor with discriminatory or aggressively may degrade or hurt students. Humor related to one's misfortune or mistake may put listeners down and discourage their enthusiasm.[20-24] Teachers need to

avoid the use of inappropriate humor in medical teaching.

Although widely practiced, the use of humor in medical teaching has not been adequately studied. In addition，there is scant literature on the difficulties and challenges for humor teaching in the medical school setting. Further research on humor use might help medical teachers to prepare useful forms of humor for teaching, and might provide other benefits on teaching style, method and content.

The purpose of this study was to assess opinions of medical students and teachers about using humor and to explore what would influence the teachers' use of humor in medical education.

METHODS

Study design

Quantitative data were generated from a self-administered survey questionnaire.

Participants' population and sample

The present study was conducted at Tongji Medical College and Tongji Hospital (Huazhong University of Science and Technology, Wuhan City, Hubei Province, China) from November 2014 to June 2015. Under the approval of the college research and ethics committee, a cross-sectional study was conducted among medical undergraduates at Tongji Medical College and physician teachers at Tongji Hospital.

A total of 327 medical students and 165 physician teachers responded to the questionnaire and signed the written informed consent. Participant characteristics are summarized in online supplementary tables 1 and 2.

Survey questionnaire

After reviewing a wide variety of literature related to the use of humor and medical education, published in international or Chinese academic journals in the last 50 years, we established two primary questionnaires for medical students and physician teachers seperatelly. The primary questionnaires were reviewed by 50 medical students and by 30 physician teachers. Each item in the questionnaire was critically evaluated. Recommendations from the students and teachers were used to develop the final questionnaires.

The student questionnaire comprised of 8 questions related to attitudes toward

the use of humor in the theoretical lecture. For all the questions in our study, there was no option for respondents to suggest other responses. Writing survey questions are listed below in the order in which they were presented to respondents.

- What is the proportion of the medical curriculum during which you felt bored? (Single-choice)

  A. Always (100%)

  B. Usually (80%)

  C. Often (60%)

  D. Sometimes (40%)

  E. Seldom (20%)

  F. Rarely (10%)

  G. Never (0%)

- Do you agree with using humor in medical teaching? (Single-choice)

  A. Strongly agree

  B. Agree

  C. Neutral

  D. Disagree

  E. Strongly disagree

- What are the benefits of using humor in medical teaching? (Multiple-choice)

  A. Create a relaxed classroom atmosphere

  B. Make learning experience more positive and enjoyable

  C. Help student-instructor interaction by improving rapport

D. Focus students' attention on the theme

E. Remembering more information over time

- How many times of humor do you think is appropriate in a 45-minute theoretical course (each class period is 45 minutes in Tongji Medical College)? (Single-choice)

A. 1

B. 2

C. 3

D. 4

E. 5

F. > 5

- Which forms of humor did teachers use in past medical courses? (Multiple-choice)

A. Interesting clinical cases

B. Spontaneous, ad-libbed humor

C. Cartoons or videos

D. Skits

E. Questions or Multiple-choice items

F. Planned, non-spontaneous humor

G. Network catchwords

H. Opening jokes

I. Quotations or analogies

- Which do you consider is the most effective form of humor, and please rank them using a 9-point Likert scale ranging from most effective (9-points) to least effective (1-point).

  A. Interesting clinical cases

  B. Spontaneous, ad-libbed humor

  C. Cartoons or videos

  D. Planned, non-spontaneous humor

  E. Opening jokes

  F. Questions or Multiple-choice items

  G. Network catchwords

  H. Skits

  I. Quotations or analogies

- What do you think constitutes inappropriate humor during teaching? (Multiple-choice)

  A. Sarcasm

  B. Mockery

  C. Humor irrelevant to the course material

  D. Instructor appearing as performer

  E. Ridicule

- Which disadvantages do you think inappropriate humor may have during teaching? (Multiple-choice)

  A. Spend time on an irrelevant subject

B. Distracts attention

C. Disrupts solemn atmosphere

D. Cannot help improve classroom performance

Similarly, a survey was conducted among physician teachers. The physician questionnaire comprised of 8 questions to investigate not only the aforementioned questions, but also difficulties in using humor and how to address them.

- What is the motivation to use humor? (Multiple-choice)

  A. To foster a relaxed classroom atmosphere

  B. To obtain self-satisfaction as an instructor

  C. To foster joviality brought on by students' laughter

  D. To get positive feedback during instructor evaluation

- Which difficulty do you face when using humor in teaching? (Multiple-choice)

  A. Lack of appropriate humor related to course material

  B. Humor did not reach the expected effect

  C. Depression or frustration when humor falls flat

  D. Time-consuming

- Which of the following options can help to use humor during teaching? (Multiple-choice)

  A. Collecting humorous materials during daily work and life

  B. Making full use of network resources

  C. Classroom observation of teachers with a reputation of using humor

D. Preparing the teaching content in advance

E. Reading books and articles about humor

F. Learn from instructors with a reputation for teaching using humor

G. Professional training provided by medical college

In the same questionnaire, data were also collected on physician teachers' medical discipline, gender, academic rank, age, and teaching experience in years.

Statistical analysis

Questionnaires with missing items were considered ineffective and excluded from subsequent analysis. The data collected were tabulated in Microsoft Excel 2014, and frequencies and percentages were calculated for quantitative variables. Data were demonstrated as mean ± SEM or simple number as appropriate. The data was analyzed using descriptive statistics in this study. Data collection and analysis were performed simultaneously.

RESULTS

Demographic data of participants

Three hundred twenty-seven medical students (96% response rate) at the Tongji Medical College responded to the questionnaire. As shown in online supplementary table 1, 52% of respondents were female, with 53% aged 17 to 20 years old and 47% aged 21 to 25 years old. The proportion of students in each year (first to fifth) was 11%, 19%, 29%, 26% and 15%, respectively.

A total of 165 physician teachers at Tongji Hospital responded to the questionnaire (91% response rate): 56% of respondents were male, with age ranging from 26 to 81 years, and academic rank distributed as follows: 22% Professors, 50% Associate Professors and 28% Assistant Professors. Teaching experience ranged from 1 to 35 years; 27% with 1–9 years, 35% with 10–19 years, and 38% with 20 years or more (online supplementary table 2).

Opinions of medical students and teachers on humor teaching

In the present study, 87% students felt that over 40% of the class was bored (table 1). Among students, 45% strongly agreed and 42% agreed with using of humor in medical teaching, while the corresponding percentages for teachers were 52% and 35%, respectively (table 2). The majority of students agreed that humor could be used to: create a relaxed classroom atmosphere (94%); make the learning experience more positive and enjoyable (90%); help student-teacher interaction by improving rapport (82%); focus students' attention on the theme (67%); and better remember more information over time (64%). As for teachers, the approval rate for the items above was 82%, 80%, 77%, 74%, and 55%, respectively.

Most students emphasized that humor worked best in a small amount: two (19%), three (36%) or four (21%) humorous remarks per 45-minute session. Most teachers used two (38%) or three (31%) humorous remarks per 45-minute session, while 12% used four humorous remarks. In terms of the humor type used by teachers in past courses, physicians mentioned: interesting clinical cases (70%); spontaneous, ad-libbed humor (67%); cartoons or videos (21%); skits (17%); questions or Multiple-choice items (13%); planned, non-spontaneous humor (12%); network catchwords (11%); opening jokes (7%) and quotations or analogies (2%) (table 2).

One area of significance in this study is how students evaluated the effectiveness of each humor type (table 3). In this study, interesting clinical case was ranked highest (mean 8 ± 0.05), followed by spontaneous, ad-libbed humor (mean 7 ± 0.08), cartoons or videos (mean 7 ± 0.08), and planned, non-spontaneous humor (mean 6 ± 0.08).

As for the potential disadvantage of using inappropriate humor in medical teaching, humor related to sarcasm and mockery received low evaluations from the students (61% and 60% disapproval rate, respectively). Students emphasized that inappropriate humor might: spend time on an irrelevant subject (56%); distract their attention (35%); disrupt the solemn atmosphere (13%); and cannot help improve classroom performance (12%) (table 4).

Influencing factor of humor teaching application

As is shown in table 5, the main motivation for teachers to use humor was to foster a relaxed classroom atmosphere (63%). Self-satisfaction (38%) and a sense of joviality brought on by students' laughter (35%) also were considered as helpful to

inspire teachers to use humor during class. Teachers reported a variety of difficulties when using of humor in teaching, including: lack of humor related to course material (42%); humor did not reach the expected effect (32%); depression or frustration when humor falls flat (26%); and preparing humor is quite time-consuming (14%).

Teachers reported that collecting humorous materials in daily work and life in advance (70%); making full use of network resource (29%); classroom observations of teachers with a reputation for using humor (24%); preparing the teaching content in advance (21%); reading books and articles about humor (11%); learn from teachers with reputation for humor teaching (8%); and professional training provided by medical college (4%) could improve their ability of using humor in the theoretical lecture.

DISCUSSION

In a teaching hospital, physicians usually serve the dual role of clinician and teacher with subject matter expertise and strong interest in student development. Ernest Leroy stated that: "a poor surgeon hurts 1 person at a time but a poor teacher hurts 130".[3 17] While effective teaching in medicine is essential to produce good quality doctors.[25] Almost none of the physician teachers have professional training on how to teach or pass on knowledge effectively much less teaching with humor. It has been established that the uses of humor in medical education improves learning enthusiasm, consciousness, efficiency and quality.[15, 26, 27] Few studies thus far have been conducted on the perspectives of medical students and teachers on using humor in the theoretical lecture and what influences the use of humor in medical teaching. This study attempted to identify the attitude toward using humor in teaching and how to effectively use humor during class.

In the present study, 53% of students felt that more than half their classes were boring, with nearly 80% of classes overall being considered boring. We have to point out that knowing that the survey is about humor might influence students' answers. There is general agreement that theoretical lectures tend to be boring.[28] Similar findings have been reported by UCLA's Higher Education Research Institute, with 35.6% of freshman students and 37% of seniors reporting being frequently bored in class.[2 14 17] There are strategies like planning the course, conducting activities that appeal to all learning styles, creating a classroom with active participation of students, combining open-ended tasks and those with well-defined goals could help to improve

the classroom environment. Cohen documented a high correlation between teaching efficiency and students' interest, with students becoming more attentive if humor was used in teaching, consistent with the current prevailing belief. [29 30]

In the present study, 87% of students and teachers agreed with using humor in the theoretical lecture (table 2). Similarly, in a study by Torok, McMorris and Lin, only 2 percent of students did not believe in the usefulness of humor in classrooms.[11] The students and teachers in the present study asserted that the use of humor created a relaxed classroom atmosphere, made learning enjoyable, and enhanced learning effectiveness (table 2). Fostering a relaxed classroom atmosphere, obtaining self-satisfaction as an teacher and fostering joviality brought on by students' laughter were the main motivations for the teachers to use humor in teaching (table 5).

Teachers appeared to use humor in a variety of ways in the present study (table 2). Interesting clinical case was noted to be the most effective humor type, followed by ad-libbed humor, and cartoons, among those with the highest ratings (table 3). Relating learning to clinical cases seem to be generally liked by medical students in clinical learning. It's quite amazing that interesting clinical case was noted to be the most popular type of humor both among teachers and students in the present study. There are different approaches to improving classroom environment by interesting clinical cases, including unusual case, detour that the mistake the doctor made during the process of diagnosing disease, the origin of medical terminology, etc. For example, physician could deepen the knowledge of asymptomatic carrier through the story of Mary Mallon who infected seven families in 1906 with the typhoid, and impress

students the conception of anatomical term Achilles through its derivation from the Greek god of war during the Trojan War.

Distinguishing what is appropriate and inappropriate humor in an educational culture is essential to become a qualified teacher.[31] According to Wanzer and Sarah's approach to humor teaching, inappropriate humor conveying aggressive/hostile or sexual messages would be considered inappropriate by students.[3] [11] Jayasuriya-Illesinghe stated that negative interactions with teachers would harass students.[32] This is similar to the findings of Vimmi, he found that students felt embarrassing and wished to never have a class with teachers who said sexually offensive or sarcasm jokes.[33] Consist with previous studies, our study showed that more than 60% of students opposed mockery and sarcasm. For example, laughing at patients or students' ignorance on disease was both considered to be inappropriate.

However, additional research by Chiarello, Kaplan, and Pascoe advocated the positive effects of laughter to remember content in the class.[26] [34] In the present study, 64% of students held that they remembered more information over time when humor is used in the theoretical lecture. The importance of using humor that is associated with the teaching topic has been stressed by Brito and Chauvet.[8] [16] Our study also found that most students emphasized that humor should contribute to the teaching topic. Humor which was irrelevant to the subject might be a waste of time and distract students' attention (table 4).

Humor in the theoretical lecture could be divided into two categories: high risk and low risk.[17] Ad-libbed humor is a high risk type of humor because it is most likely

to fail to elicit laughter, and teachers might feel depressed or frustrated when the humor falls flat.[17] Even worse, ad-libbed humor unrelated to the subject may be distracting. Ziegler listed seven examples of basic types of low risk humor: planned ad-lib that are not spontaneous, cartoons, quotations and questions, top 10 lists, multiple-choice items, skits or dramatizations, and anecdotes.[17] Except for much higher chance to get laugh, elaborately planned ad-lib could also focus on the subject and avoid distraction. However, in the present study, ad-libbed humor is the second most frequently used type of humor by teachers (table 2) and also the second most effective type ranked by students (table 3). In a word, teachers preferred to use spontaneous ad-lib rather than planned ad-lib. Moreover, students felt planned ad-lib was acceptable in the present study (table 3).

Very few studies have focused on the difficulties and challenges that physicians may face during teaching. Physician teachers in this study were asked to identify the type of challenges they faced while transmitting a humorous message. Lacking appropriate humor material related to clinical skills (course material) was ranked at the top, and that this challenge might be addressed by collect humorous materials in daily work and efficiently using the internet. In the present study, physician teachers also affirmed that using humor in the theoretical lecture is influenced by lack of skills. Previous studies have attempted to address these challenges. Hueppchen stated that most of the medical faculty learned to teach by observing their mentors or their teachers.[35]

Limitations

While the present study provides insight into the use of humor in medical education, it has some limitations. Firstly, it is a single center study on a relatively small study population. Secondly, the present study relies on the memory of the participants completing the questionnaire. A crucial limitation of this approach is the possibility of recall bias. Participants may not have recalled information accurately. Thirdly, teachers and students may have different understanding about humor. Further studies are needed to explore the correlation of what teachers thought was funny and what students thought was funny.

CONCLUSION

The present study extends our knowledge of medical student and physician teacher's opinions on using humor in the theoretical lecture and identifies appropriate and inappropriate humor behaviors. By sharing ideas, perspectives, and benefits related to using humor in the theoretical lecture, the findings of this study might be of benefit to assist physician teachers in using humor appropriately to successfully establish good lecture courses.

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Contributors XQQ and LS designed the study and the questionnaire and drafted the paper. YPL participated in data gathering, analysis and interpretation. XFW and YY implemented the study and helped some of the data analysis. HLZ and CTZ took part in the discussion and modification of the design and the questionnaire. All authors have seen and agreed to the submission of the final manuscript.

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Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement No additional data are available.

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Table 1 The attitude toward medical curriculum

Variables	Students (n=327) (% Yes)
How often have you felt bored during the medical curriculum? (Single-choice)	
A. Always (100%)	2
B. Usually (80%)	15
C. Often (60%)	36
D. Sometimes (40%)	34
E. Seldom (20%)	10
F. Rarely (10%)	3
G. Never (0%)	0

Table 2 The attitude toward humor compared between physicians and students

Variables	Physicians (n=165) (% Yes)	Students (n=327) (% Yes)
Do you agree with using of humor in medical teaching? (Single-choice)		
A. Strongly agree	52	45
B. Agree	35	42
C. Neutral	13	11
D. Disagree	0	2
E. Strongly disagree	0	0
What are the benefits of using humor in medical teaching? (Multiple-choice)		
A. Create a relaxed classroom atmosphere	82	94
B. Make learning experience more positive and enjoyable	80	90
C. Help student-instructor interaction by improving rapport	77	82
D. Focus students' attention on the theme	74	67
E. Remembering more information over time	55	64
How many times of humor do you think are appropriate during a 45-minute course? (Single-choice)		
A. 1	5	4
B. 2	38	19

C. 3	31	36
D. 4	12	21
E. 5	9	14
F. > 5	5	6
Which form of humor have physicians used in teaching? (Multiple-choice)		
A. Interesting clinical cases	70	89
B. Spontaneous, ad-libbed humor	67	67
C. Cartoons or videos	21	27
D. Skits	17	39
E. Questions or Multiple-choice items	13	18
F. Planned, non-spontaneous humor	12	20
G. Network catchwords	11	13
H. Opening jokes	7	29
I. Quotations or analogies	2	17

Table 3 Score of humor types students considered

Variables	Students (n=327)
Which do you consider to be the most effective form of humor? Please rank from most to least effective. (mean ± SEM)	
A. Interesting clinical cases	8 ± 0.05
B. Spontaneous, ad-libbed humor	7 ± 0.08
C. Cartoons or videos	7 ± 0.08
D. Planned, non-spontaneous humor	6 ± 0.08
E. Opening jokes	5 ± 0.09
F. Questions or Multiple-choice items	5 ± 0.09
G. Network catchwords	3 ± 0.08
H. Skits	2 ± 0.07
I. Quotations or analogies	2 ± 0.06

Table 4 The appropriate or inappropriate type of humor

Variables	Students (n=327) (% Yes)
What do you think constitutes inappropriate humor during teaching? (Multiple-choice)	
A. Sarcasm	61
B. Mockery	60
C. Humor irrelevant to the course material	34
D. Instructor appearing as performer	30
E. Ridicule	15
Which disadvantages do you think inappropriate humor may have during teaching? (Multiple-choice)	
A. Spend time on an irrelevant subject	56
B. Distracts attention	35
C. Disrupts solemn atmosphere	13
D. Cannot help improve classroom performance	12

Table 5 Influencing factor of humor teaching application

Variables	Physicians (n=165) (% Yes)
How often do you use humor in medical teaching? (Single-choice)	
A. Always (100%)	2
B. Usually (80%)	8
C. Often (60%)	13
D. Sometimes (40%)	51
E. Seldom (20%)	16
F. Rarely (10%)	9
G. Never (0%)	1
What is the motivation to use humor? (Multiple-choice)	
A. To foster a relaxed classroom atmosphere	63
B. To obtain self-satisfaction as an instructor	38
C. To foster joviality brought on by students' laughter	35
D. To get positive feedback during instructor evaluation	6
Which difficulty do you face when using humor in teaching? (Multiple-choice)	
A. Lack of appropriate humor related to course material	42
B. Humor did not reach the expected effect	32
C. Depression or frustration when humor falls flat	26
D. Time-consuming	14
Which of the following options can help to use humor during teaching? (Multiple-choice)	

A. Collecting humorous materials during daily work and life	70
B. Making full use of network resources	29
C. Classroom observation of teachers with a reputation of using humor	24
D. Preparing the teaching content in advance	21
E. Reading books and articles about humor	11
F. Learn from instructors with a reputation for teaching using humor	8
G. Professional training provided by medical college	4

eTable 1

Demographic data of participating students (n = 327)

Variables	Frequency (%)
Age (years)	
17 – 20	174 (53)
21 – 25	153 (47)
Grade	
Fifth	50 (15)
Fourth	86 (26)
Third	94 (29)
Second	62 (19)
First	35 (11)
Gender	
Male	156 (48)
Female	171 (52)

eTable 2

Demographic data of participating physicians (n = 165)

Variables	Frequency (%)
Age (years)	
26 – 39	51 (31)
40 – 59	84 (51)
≥ 60	30 (18)
Range = 26 - 81	
Designation	
Professor	37 (22)
Associate Professor	82 (50)
Assistant Professor	46 (28)
Gender	
Male	93 (56)
Female	72 (44)
Teaching experience (years)	
1 – 9	45 (27)
10 – 19	57 (35)
≥ 20	63 (38)
Range = 1 – 35	

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract Page 1, Page 3
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found Page 3
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported Page 5, Page 6
Objectives	3	State specific objectives, including any prespecified hypotheses Page 6
Methods		
Study design	4	Present key elements of study design early in the paper Page 7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection Page 7
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants Page 7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable Not applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group Page 7, Page 12
Bias	9	Describe any efforts to address potential sources of bias Page 12, Page 20
Study size	10	Explain how the study size was arrived at Page 7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why Page 12
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding Page 12
		(*b*) Describe any methods used to examine subgroups and interactions Not applicable
		(*c*) Explain how missing data were addressed Page 12
		(*d*) If applicable, describe analytical methods taking account of sampling strategy Not applicable
		(*e*) Describe any sensitivity analyses Not applicable
Results		

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed Page 13
		(b) Give reasons for non-participation at each stage Not applicable
		(c) Consider use of a flow diagram Not applicable
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders Page 13
		(b) Indicate number of participants with missing data for each variable of interest Not applicable
Outcome data	15*	Report numbers of outcome events or summary measures Page 13, Page 14, Page 15
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included\ Not applicable
		(*b*) Report category boundaries when continuous variables were categorized Not applicable
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period Not applicable
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses Not applicable
Discussion		
Key results	18	Summarise key results with reference to study objectives Page 16, Page 17, Page 18, Page 19
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias Page 20
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence Page 16, Page 17, Page 18, Page 19, Page 20
Generalisability	21	Discuss the generalisability (external validity) of the study results Page 20
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based Not applicable

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely

available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Use of humor in medical education: a survey of students and teachers at a medical school in China

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Use of humor in medical education: a survey of students and teachers at a medical school in China

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Running title: Humor in medical education

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ABSTRACT

Objective: Humor is a powerful resource in medical education. The purpose of this study is to investigate what students and teachers think about the use of humor. What challenges do teachers face in using humor and how they address them are also the subject of the present study.

Design: Separate cross-sectional questionnaire surveys.

Setting: Tongji Medical College and Tongji Hospital in China.

Participants: 327 students at Tongji Medical College and 165 physician teachers at Tongji Hospital in China.

Main outcome measures: The primary study outcome was assessed by proporation.

Results: Eighty-seven percent of student and teacher respondents agreed with using humor in the didactic setting. They felt humor fostered a positive didactic atmosphere. Interesting clinical case was the most frequently used humor type by teachers and considered the most effective by students. Lack of humorous materials related to the lecture subject was the main challenge to humor use cited by teachers. Collecting humorous materials in teacher's daily work and life, observing teachers with a reputation for successfully using humor, and efficiently using the internet enhanced humor use ability.

Conclusion: The present study confirms that most medical students and physician teachers support the use of humor in medical didactics, with particular strategies aiding its use and positive impact.

Keywords: Humor, Medical student, Physician teacher, Medical education

Strengths and limitations of this study

- This is the first questionnaire survey of medical students and physician teachers regarding use of humor in medical education.
- The study provides useful information of medical student and teacher's opinions on using humor in the theoretical lecture and identifies appropriate and inappropriate humor behaviors.
- The main limitation of this study is that it is a single center study on a relatively small study population.

INTRODUCTION

Acquiring basic clinical skills is the primary mission of medical students.[1] Historically, education has been considered as a solemn endeavor, and using humor in the learning process has not been valued or encouraged. In recent years, there has been a shift in societal attitudes toward the adoption of a more relaxed learning environment and an increased emphasis on making learning more enjoyable.[2-6]

Humor can affect psychological, physiological, and immunological functions by humanizing, encouraging, defusing, illustrating, and reducing anxiety.[7-9] McCoy interviewed 108 first year medical students, the result of the study indicated that humor could foster engagement through demonstrating interest in the activities.[10] It has been found that students might be more motivated to learn and get involved in a positive classroom atmosphere.[2 11-13] Several studies have examined how humor can help students to reduce stress, promote creativity, increase motivation, and assimilate knowledge more quickly.[3 12 14-16] Informal observation suggests that the use of humor is widespread in medical education. At the Sydney Children's Hospital, almost 80% of physicians used humor in their teaching sessions, and regularly elicited laughter from their students.[17]

A positive relationship was found between humor and student's test performance.[15 18 19] While some forms of inappropriate humor with discriminatory or aggressively may degrade or hurt students. Humor related to one's misfortune or mistake might put listeners down and discourage their enthusiasm.[20-24] Teachers need

to avoid the use of inappropriate humor in medical teaching.

Although widely practiced, the use of humor in medical teaching has not been adequately studied. In addition，there is scant literature on the difficulties and challenges for humor teaching in the medical school setting. Research on humor use might help medical teachers to prepare useful forms of humor for teaching, and might provide other benefits on teaching style, method and content.

The purpose of this study was to assess opinions of medical students and teachers about using humor and to explore what would influence the teachers' use of humor in medical education.

METHODS

Study design

Quantitative data were generated from a self-administered survey questionnaire.

Participants' population

The present study was conducted at Tongji Medical College and Tongji Hospital (Huazhong University of Science and Technology, Wuhan City, Hubei Province, China) from November 2014 to June 2015. Under the approval of the college research and ethics committee, a cross-sectional study was conducted among medical undergraduates at Tongji Medical College and physician teachers at Tongji Hospital. All study participants signed informed consent forms before enrolment.

Survey questionnaire

After reviewing a wide variety of literature related to the use of humor and medical education, published in international or Chinese academic journals in the last 50 years, we established two primary questionnaires for medical students and physician teachers seperatelly. We conducted a pilot study to ascertain any perceived problems and assess the acceptability of the questions. The paper-based primary questionnaires were reviewed by a random sample of 50 medical students at Tongji Medical College and 30 physician teachers at Tongji Hospital. Each item in the questionnaire was critically evaluated. Recommendations from the students and teachers were used to develop the final questionnaires. A total of 327 medical students

and 165 physician teachers responded to the paper-based final questionnaire. Participant characteristics were summarized in online supplementary tables 1 and 2.

The student questionnaire comprised of 8 questions related to attitudes toward the use of humor in the theoretical lecture. For all the questions in our study, there was no option for respondents to suggest other responses. Writing survey questions are listed below in the order in which they were presented to respondents.

- What is the proportion of the medical curriculum during which you felt bored? (Single-choice)

  A. Always (100%)

  B. Usually (80%)

  C. Often (60%)

  D. Sometimes (40%)

  E. Seldom (20%)

  F. Rarely (10%)

  G. Never (0%)

- Do you agree with using humor in medical teaching? (Single-choice)

  A. Strongly agree

  B. Agree

  C. Neutral

  D. Disagree

  E. Strongly disagree

- What are the benefits of using humor in medical teaching? (Multiple-choice)

A. Create a relaxed classroom atmosphere

B. Make learning experience more positive and enjoyable

C. Help student-instructor interaction by improving rapport

D. Focus student's attention on the theme

E. Remember more information over time

- How many times of humor do you think is appropriate in a 45-minute theoretical course (each class period is usually 45 minutes in Tongji Medical College)? (Single-choice)

A. 1

B. 2

C. 3

D. 4

E. 5

F. > 5

- Which forms of humor did teachers use in past medical courses? (Multiple-choice)

A. Interesting clinical cases

B. Spontaneous, ad-libbed humor

C. Cartoons or videos

D. Skits

E. Questions or multiple-choice items

F. Planned, non-spontaneous humor

G. Network catchwords

H. Opening jokes

I. Quotations or analogies

- Which do you consider is the most effective form of humor, and please rank them using a 9-point Likert scale ranging from most effective (9-points) to least effective (1-point).

A. Interesting clinical cases

B. Spontaneous, ad-libbed humor

C. Cartoons or videos

D. Planned, non-spontaneous humor

E. Opening jokes

F. Questions or multiple-choice items

G. Network catchwords

H. Skits

I. Quotations or analogies

- What do you think constitutes inappropriate humor during teaching? (Multiple-choice)

A. Sarcasm

B. Mockery

C. Humor irrelevant to the course material

D. Instructor appearing as performer

E. Ridicule

- Which disadvantages do you think inappropriate humor may have during teaching? (Multiple-choice)

  A. Spend time on an irrelevant subject

  B. Distract attention

  C. Disrupt solemn atmosphere

  D. Cannot help improve classroom performance

Similarly, a survey was conducted among physician teachers. The physician questionnaire comprised of 8 questions to investigate not only the aforementioned questions, but also difficulties in using humor and how to address them.

- What is the motivation to use humor? (Multiple-choice)

  A. To foster a relaxed classroom atmosphere

  B. To obtain self-satisfaction as an instructor

  C. To foster joviality brought on by student's laughter

  D. To get positive feedback during instructor evaluation

- Which difficulty do you face when using humor in teaching? (Multiple-choice)

  A. Lack of appropriate humor related to course material

  B. Humor doesn't reach the expected effect

  C. Depression or frustration when humor falls flat

  D. Time-consuming

- Which of the following options can help to use humor during teaching? (Multiple-choice)

A. Collecting humorous materials during daily work and life

B. Making full use of network resources

C. Classroom observation of teachers with a reputation of successfully using humor

D. Preparing the teaching content in advance

E. Reading books and articles about humor

F. Professional training provided by medical college

In the same questionnaire, data were also collected on physician teachers' medical discipline, gender, academic rank, age, and teaching experience in years.

Statistical analysis

Questionnaires with missing items were considered ineffective and excluded from subsequent analysis. The data collected were tabulated in Microsoft Excel 2014, and frequencies and percentages were calculated for quantitative variables. Data were demonstrated as mean ± SEM or simple number as appropriate. The data was analyzed using descriptive statistics in this study. Data collection and analysis were performed simultaneously.

RESULTS

Demographic data of participants

Three hundred twenty-seven medical students (96% response rate) at the Tongji Medical College responded to the questionnaire. As shown in online supplementary table 1, 52% of respondents were female, with 53% aged 17 to 20 years old and 47% aged 21 to 25 years old. The proportion of students in each year (first to fifth) was 11%, 19%, 29%, 26% and 15%, respectively.

A total of 165 physician teachers at Tongji Hospital responded to the questionnaire (91% response rate): 56% of respondents were male, with age ranging from 26 to 81 years, and academic rank distributed as follows: 22% Professors, 50% Associate Professors and 28% Assistant Professors. Teaching experience ranged from 1 to 35 years; 27% with 1–9 years, 35% with 10–19 years, and 38% with 20 years or more (online supplementary table 2).

Opinions of medical students and teachers on humor teaching

In the present study, 2% of students felt 100% of their classes were boring, 15% of students felt 80% of their classes were boring, 36% of students felt 60% of their classes were boring, 34% of students felt 40% of their classes were boring, 10% of students felt 20% of their classes were boring, 3% of students felt 10% of their classes were boring (table 1).

Among students, 45% strongly agreed and 42% agreed with using humor in medical teaching, while the corresponding percentages for teachers were 52% and 35% respectively (table 2). The majority of students agreed that humor could be used to create a relaxed classroom atmosphere (94%); make the learning experience more

positive and enjoyable (90%); help student-teacher interaction by improving rapport (82%); focus student's attention on the theme (67%); and remember more information over time (64%). As for teachers, the approval rates for the items above were 82%, 80%, 77%, 74%, and 55%, respectively.

Most students emphasized that humor worked best in a small amount: two (19%), three (36%) or four (21%) humorous remarks per 45-minute session. Most teachers used two (38%) or three (31%) humorous remarks per 45-minute session, while 12% used four humorous remarks. In term of the humor types used by teachers in past courses, physicians mentioned: interesting clinical cases (70%); spontaneous, ad-libbed humor (67%); cartoons or videos (21%); skits (17%); questions or multiple-choice items (13%); planned, non-spontaneous humor (12%); network catchwords (11%); opening jokes (7%) and quotations or analogies (2%) (table 2).

One area of significance in this study is how students evaluated the effectiveness of each humor type (table 3). In this study, interesting clinical case was ranked highest (mean 8 ± 0.05), followed by spontaneous, ad-libbed humor (mean 7 ± 0.08), cartoons or videos (mean 7 ± 0.08), and planned, non-spontaneous humor (mean 6 ± 0.08).

As for the potential disadvantage of using inappropriate humor in medical teaching, humor related to sarcasm and mockery received low evaluations from the students (61% and 60% disapproval rates, respectively). Students emphasized that inappropriate humor might spend time on an irrelevant subject (56%); distract their attention (35%); disrupt the solemn atmosphere (13%); and cannot help improve classroom performance (12%) (table 4).

Influencing factor of humor teaching application

As is shown in table 5, the main motivation for teachers to use humor was to foster a relaxed classroom atmosphere (63%). Self-satisfaction (38%) and a sense of joviality brought on by student's laughter (35%) also were considered as helpful to inspire teachers to use humor during class. Teachers reported a variety of difficulties when using humor in teaching, including: lack of humor related to course material (42%); humor doesn't reach the expected effect (32%); depression or frustration when humor falls flat (26%); and preparing humor is quite time-consuming (14%).

Teachers reported that collecting humorous materials in daily work and life in advance (70%); making full use of network resource (29%); classroom observations of teachers with a reputation for successfully using humor (24%); preparing the teaching content in advance (21%); reading books and articles about humor (11%); and professional training provided by medical college (4%) could improve their ability of using humor in the theoretical lecture.

DISCUSSION

In a teaching hospital, physicians usually serve the dual role of clinician and teacher with subject matter expertise and strong interest in student development. Ernest Leroy stated that: "a poor surgeon hurts 1 person at a time but a poor teacher hurts 130".[3 17] While effective teaching in medicine is essential to produce good quality doctors.[25] Almost none of the physician teachers have professional training on how to teach or pass on knowledge effectively, much less teaching with humor. It has been established that the use of humor in medical education improves learning enthusiasm, consciousness, efficiency and quality.[15, 26, 27] Few studies thus far have been conducted on the perspectives of medical students and teachers on using humor in the theoretical lecture and what influences the use of humor in medical teaching. This study attempted to identify the attitude toward using humor in teaching and how to effectively use humor during class.

In the present study, 15% of students felt 80% of their classes were boring, 36% of students felt 60% of their classes were boring (table 1). We have to point out that knowing that the survey is about humor might influence student's answers and result in reporting bias. There is general agreement that theoretical lectures tend to be boring.[28] Similar findings have been reported by UCLA's Higher Education Research Institute, with 35.6% of freshman students and 37% of seniors reporting being frequently bored in class.[2 14 17] There are strategies like planning the course, conducting activities that appeal to all learning styles, creating a classroom with active participation of students, combining open-ended tasks and those with

well-defined goals could help to improve the classroom environment. Cohen documented a high correlation between teaching efficiency and student's interest, with students becoming more attentive if humor was used in teaching, consistent with the current prevailing belief. [29]

In the present study, 87% of students and teachers agreed with using humor in the theoretical lecture (table 2). Similarly, in a study by Torok, McMorris and Lin, only 2 percent of students did not believe in the usefulness of humor in classrooms.[11] The students and teachers in the present study asserted that the use of humor created a relaxed classroom atmosphere, made learning enjoyable, and enhanced learning effectiveness (table 2). Fostering a relaxed classroom atmosphere, obtaining self-satisfaction as an teacher and fostering joviality brought on by student's laughter were the main motivations for the teachers to use humor in teaching (table 5).

Teachers appeared to use humor in a variety of ways in the present study (table 2). Interesting clinical case was noted to be the most effective humor type, followed by ad-libbed humor, and cartoons, among those with the highest ratings (table 3). Relating learning to clinical cases seemed to be generally liked by medical students in clinical learning. It's quite amazing that interesting clinical case was noted to be the most popular type of humor both among teachers and students in the present study. Interesting clinical case could make learning experience more enjoyable and also focus on the teaching topic. When clinical case is entertaining and interesting, students retain more from teaching. [30]

There are different approaches to improving classroom environment by

interesting clinical cases, including unusual case, detour that the mistake the doctor made during the process of diagnosing disease, the origin of medical terminology, etc. For example, physician could deepen the knowledge of asymptomatic carrier through the story of Mary Mallon who infected seven families in 1906 with the typhoid, and impress students the conception of anatomical term Achilles through its derivation from the Greek god of war during the Trojan War.

Distinguishing what is appropriate and inappropriate humor in an educational culture is essential to become a qualified teacher.[31] According to Wanzer and Sarah's approach to humor teaching, inappropriate humor conveying aggressive/hostile or sexual messages would be considered inappropriate by students.[3] [11] Jayasuriya-Illesinghe stated that negative interactions with teachers would harass students.[32] This is similar to the findings of Vimmi, he found that students felt embarrassing and wished to never have a class with teachers who said sexually offensive or sarcasm jokes.[33] Consist with previous studies, our study showed that more than 60% of students opposed mockery and sarcasm. For example, laughing at patient's or student's ignorance on disease was both considered to be inappropriate.

However, additional research by Chiarello, Kaplan, and Pascoe advocated the positive effects of laughter to remember content in the class.[26] [34] In the present study, 64% of students held that they remembered more information over time when humor is used in the theoretical lecture. The importance of using humor that is associated with the teaching topic has been stressed by Brito and Chauvet.[8] [16] Our study also found that most students emphasized that humor should contribute to the teaching

topic. Humor which was irrelevant to the subject might be a waste of time and distract student's attention (table 4).

Humor in the theoretical lecture could be divided into two categories: high risk and low risk.[17] Ad-libbed humor is a high risk type of humor because it is most likely to fail to elicit laughter, and teachers might feel depressed or frustrated when the humor falls flat.[17] Even worse, ad-libbed humor unrelated to the subject may be distracting. Ziegler listed seven examples of basic types of low risk humor: planned ad-lib that are not spontaneous, cartoons, quotations and questions, top 10 lists, multiple-choice items, skits or dramatizations, and anecdotes.[17] Except for much higher chance to get laugh, elaborately planned ad-lib could also focus on the subject and avoid distraction. However, in the present study, ad-libbed humor is the second most frequently used type of humor by teachers (table 2) and also the second most effective type ranked by students (table 3). In a word, teachers preferred to use spontaneous ad-lib rather than planned ad-lib. Moreover, students felt planned ad-lib was acceptable in the present study (table 3).

Very few studies have focused on the difficulties and challenges that physicians may face during teaching. Physician teachers in this study were asked to identify the type of challenges they faced while transmitting a humorous message. Lacking appropriate humor material related to clinical skills (course material) was ranked at the top, and that this challenge might be addressed by collecting humorous materials in daily work and efficiently using the internet. In the present study, physician teachers also affirmed that using humor in the theoretical lecture is influenced by lack

of skills. Previous studies have attempted to address these challenges. Hueppchen stated that most of the medical faculty learned to teach by observing their mentors or their teachers.[35]

Limitations

While the present study provides insight into the use of humor in medical education, it has some limitations. Firstly, it is a single center study on a relatively small study population. Secondly, the present study relies on the memory of the participants completing the questionnaire. A crucial limitation of this approach is the possibility of recall bias. Participants may not have recalled information accurately. Thirdly, knowing that the survey is about humor might result in reporting bias. we note this as a potential study limitation. Forthly, teachers and students may have different understanding about humor. Further studies are needed to explore the correlation of what teachers thought was funny and what students thought was funny.

CONCLUSION

The present study extends our knowledge of medical student and physician teacher's opinions on using humor in the theoretical lecture and identifies appropriate and inappropriate humor behaviors. By sharing ideas, perspectives, and benefits related to using humor in the theoretical lecture, the findings of this study might be of benefit to assist physician teachers in using humor appropriately to successfully establish good lecture courses.

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Contributors XQQ and LS designed the study and the questionnaire and drafted the paper. YPL participated in data gathering, analysis and interpretation. XFW and YY implemented the study and helped some of the data analysis. HLZ and CTZ took part in the discussion and modification of the design and the questionnaire. All authors have seen and agreed to the submission of the final manuscript.

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Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement No additional data are available.

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Table 1 The attitude toward medical curriculum

Variables	Students (n=327) (% Yes)
How often have you felt bored during the medical curriculum? (Single-choice)	
A. Always (100%)	2
B. Usually (80%)	15
C. Often (60%)	36
D. Sometimes (40%)	34
E. Seldom (20%)	10
F. Rarely (10%)	3
G. Never (0%)	0

Table 2 The attitude toward humor compared between physicians and students

Variables	Physicians (n=165) % Yes	Students (n=327) % Yes
Do you agree with using humor in medical teaching? (Single-choice)		
A. Strongly agree	52	45
B. Agree	35	42
C. Neutral	13	11
D. Disagree	0	2
E. Strongly disagree	0	0
What are the benefits of using humor in medical teaching? (Multiple-choice)		
A. Create a relaxed classroom atmosphere	82	94
B. Make learning experience more positive and enjoyable	80	90
C. Help student-instructor interaction by improving rapport	77	82
D. Focus student's attention on the theme	74	67
E. Remember more information over time	55	64
How many times of humor do you think are appropriate during a 45-minute course? (Single-choice)		
A. 1	5	4

B. 2	38	19
C. 3	31	36
D. 4	12	21
E. 5	9	14
F. > 5	5	6
Which form of humor have physicians used in teaching? (Multiple-choice)		
A. Interesting clinical cases	70	89
B. Spontaneous, ad-libbed humor	67	67
C. Cartoons or videos	21	27
D. Skits	17	39
E. Questions or multiple-choice items	13	18
F. Planned, non-spontaneous humor	12	20
G. Network catchwords	11	13
H. Opening jokes	7	29
I. Quotations or analogies	2	17

Table 3 Score of humor types students considered

Variables	Students (n=327)
Which do you consider to be the most effective form of humor? Please rank from most to least effective. (mean ± SEM)	
A. Interesting clinical cases	8 ± 0.05
B. Spontaneous, ad-libbed humor	7 ± 0.08
C. Cartoons or videos	7 ± 0.08
D. Planned, non-spontaneous humor	6 ± 0.08
E. Opening jokes	5 ± 0.09
F. Questions or multiple-choice items	5 ± 0.09
G. Network catchwords	3 ± 0.08
H. Skits	2 ± 0.07
I. Quotations or analogies	2 ± 0.06

Table 4 The inappropriate types of humor

Variables	Students (n=327) % Yes
What do you think constitutes inappropriate humor during teaching? (Multiple-choice)	
A. Sarcasm	61
B. Mockery	60
C. Humor irrelevant to the course material	34
D. Instructor appearing as performer	30
E. Ridicule	15
Which disadvantages do you think inappropriate humor may have during teaching? (Multiple-choice)	
A. Spend time on an irrelevant subject	56
B. Distract attention	35
C. Disrupt solemn atmosphere	13
D. Cannot help improve classroom performance	12

Table 5 Influencing factor of humor teaching application

Variables	Physicians (n=165) (% Yes)
How often do you use humor in medical teaching? (Single-choice)	
A. Always (100%)	2
B. Usually (80%)	8
C. Often (60%)	13
D. Sometimes (40%)	51
E. Seldom (20%)	16
F. Rarely (10%)	9
G. Never (0%)	1
What is the motivation to use humor? (Multiple-choice)	
A. To foster a relaxed classroom atmosphere	63
B. To obtain self-satisfaction as an instructor	38
C. To foster joviality brought on by student's laughter	35
D. To get positive feedback during instructor evaluation	6
Which difficulty do you face when using humor in teaching? (Multiple-choice)	
A. Lack of appropriate humor related to course material	42
B. Humor doesn't reach the expected effect	32
C. Depression or frustration when humor falls flat	26
D. Time-consuming	14
Which of the following options can help to use humor during teaching? (Multiple-choice)	

A. Collecting humorous materials during daily work and life	70
B. Making full use of network resources	29
C. Classroom observation of teachers with a reputation of successfully using humor	24
D. Preparing the teaching content in advance	21
E. Reading books and articles about humor	11
F. Professional training provided by medical college	4

eTable 1

Demographic data of participating students (n = 327)

Variables	Frequency (%)
Age (years)	
17 – 20	174 (53)
21 – 25	153 (47)
Grade	
Fifth	50 (15)
Fourth	86 (26)
Third	94 (29)
Second	62 (19)
First	35 (11)
Gender	
Male	156 (48)
Female	171 (52)

eTable 2

Demographic data of participating physicians (n = 165)

Variables	Frequency (%)
Age (years)	
26 – 39	51 (31)
40 – 59	84 (51)
≥ 60	30 (18)
Range = 26 - 81	
Designation	
Professor	37 (22)
Associate Professor	82 (50)
Assistant Professor	46 (28)
Gender	
Male	93 (56)
Female	72 (44)
Teaching experience (years)	
1 – 9	45 (27)
10 – 19	57 (35)
≥ 20	63 (38)
Range = 1 – 35	

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract Page 1, Page 2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found Page 2
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported Page 4, Page 5
Objectives	3	State specific objectives, including any prespecified hypotheses Page 5
Methods		
Study design	4	Present key elements of study design early in the paper Page 6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection Page 6, Page 7, Page 8, Page 9, Page 10, Page 11
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants Page 6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable Not applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group Page 6, Page 7, Page 8, Page 9, Page 10, Page 11
Bias	9	Describe any efforts to address potential sources of bias Page 11, Page 15, Page 19
Study size	10	Explain how the study size was arrived at Page 6, Page 7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why Page 11
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding Page 11
		(*b*) Describe any methods used to examine subgroups and interactions Not applicable
		(*c*) Explain how missing data were addressed Page 11
		(*d*) If applicable, describe analytical methods taking account of sampling strategy Not applicable
		(*e*) Describe any sensitivity analyses Not applicable
Results		

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed Page 12
		(b) Give reasons for non-participation at each stage Not applicable
		(c) Consider use of a flow diagram Not applicable
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders Page 12
		(b) Indicate number of participants with missing data for each variable of interest Not applicable
Outcome data	15*	Report numbers of outcome events or summary measures Page 12, Page 13, Page 14
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included\ Not applicable
		(*b*) Report category boundaries when continuous variables were categorized Not applicable
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period Not applicable
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses Not applicable
Discussion		
Key results	18	Summarise key results with reference to study objectives Page 15, Page 16, Page 17, Page 18, Page 19
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias Page 15, Page 19
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence Page 15, Page 16, Page 17, Page 18, Page 19
Generalisability	21	Discuss the generalisability (external validity) of the study results Page 19
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based Not applicable

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely

available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.