The over-optimistic portrayal of life-supporting treatments in newspapers and on the Internet: a cross-sectional study using extra-corporeal membrane oxygenation as an example

Yen-Yuan Chen1,2, Likwang Chen3, Yu-Hui Kao4, Tzong-Shinn Chu2,5, Tien-Shang Huang1,6* and Wen-Je Ko7,8

Abstract

Background: Extra-corporeal membrane oxygenation has been introduced to clinical practice for several decades. It is unclear how internet and newspapers portray the use of extra-corporeal membrane oxygenation. This study were: (1) to quantify the coverage of extra-corporeal membrane oxygenation use in newspapers and on the Internet; (2) to describe the characteristics of extra-corporeal membrane oxygenation users presented in newspaper articles and the Internet web pages in comparison with those shown in extra-corporeal membrane oxygenation studies in Taiwan; and (3) to examine the survival rates of extra-corporeal membrane oxygenation users presented in newspaper articles and the Internet web pages in comparison with those in Taiwan and in the Extracorporeal Life Support Registry Report International Summary for January 2014.

Methods: All issues of Taiwan’s four major newspapers from 2006 to 2010 were reviewed. In October 2011, a search of Internet web pages was performed based on the subjects of "yeh-ko-mo" (extra-corporeal membrane oxygenation in Traditional Chinese), "ECMO", and "extra-corporeal membrane oxygenation." All the Internet web pages and newspaper articles recounting the use of extra-corporeal membrane oxygenation were reviewed. The information, such as patient characteristic and the status at hospital discharge, was collected.

Results: The survival rate of extra-corporeal membrane oxygenation use shown on the Internet (83.97%) was significantly higher than all the survival rates reported in Taiwan’s literature (p < .01) and in the Extracorporeal Life Support Registry Report International Summary for January 2014 (p < .01). In addition, the survival rate of extra-corporeal membrane oxygenation use shown in newspapers (61.54%) was significantly higher than the average survival rate (43%) reported in Taiwan’s literature, the pediatric average survival rate (51%), and the adult average survival rate (47%) in the Extracorporeal Life Support Registry Report International Summary for January 2014.

Conclusions: Internet and newspapers both showed over-optimistic survival to hospital discharge for patients sustained by extra-corporeal membrane oxygenation. Internet was more likely to provide optimistic information for aggressive life-supporting treatments such as extra-corporeal membrane oxygenation than newspapers as indicated by survival to hospital discharge.

Keywords: Life-supporting treatment, Extra-corporeal membrane oxygenation, Media, Internet, Newspaper

* Correspondence: huangts@ntu.edu.tw
1Department of Social Medicine, National Taiwan University College of Medicine, No. 1, Rd. Ren-Ai sec. 1, Taipei 10051, Taiwan
2Department of Internal Medicine, National Taiwan University Hospital, No. 7, Rd. Chong-Shan S, Taipei 10002, Taiwan
6Department of Internal Medicine, National Taiwan University Hospital, No. 7, Rd. Chong-Shan S, Taipei 10002, Taiwan
Full list of author information is available at the end of the article

© 2014 Chen et al.; licensee BioMed Central Ltd. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/2.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly credited. The Creative Commons Public Domain Dedication waiver (http://creativecommons.org/publicdomain/zero/1.0/) applies to the data made available in this article, unless otherwise stated.
Background

Extra-corporeal membrane oxygenation (ECMO) is a technique for providing cardiac and respiratory support to patients by using a modified heart-lung machine. ECMO can support life for days to weeks, permitting treatment and recovery during severe cardiac or respiratory failure. According to the Extracorporeal Life Support Registry Report International Summary for January 2014 (ECLS 2014), the annual number of patients supported by ECMO increased from 1,644 in 1990 to 4,357 in 2013. From 1990 to 2013, 58,842 patients received ECMO for cardiac or respiratory failure, or received ECMO-assisted cardiopulmonary resuscitation (CPR), with 35,307 (60%) surviving to hospital discharge. Of the 58,842 patients supported by ECMO, 33,412 (56.78%) were neonatal patients, who have the highest rates of immediate survival after ECMO use, and the highest rates of survival to hospital discharge, compared with adult and pediatric patients. Of the 5,146 adult patients who received ECMO because of respiratory failure, 2,905 (56.45%) survived to hospital discharge. Of the 4,042 patients who received ECMO because of cardiac failure, 1,636 (40.48%) survived to hospital discharge. The average rate of adult ECMO patients surviving to hospital discharge was 46.96% [1].

Taiwan has become one of the major countries for ECMO use. In 2010, 1,126 Taiwanese patients received ECMO support [2]. In six Taiwanese studies reporting the survival of ECMO users with cardiac failure, the survival rates at hospital discharge ranged from 27.78% to 64% [3-8], with an approximate average survival rate of 44.03%. A study by Chen et al. in 2011 reported a 31.58% survival rate of ECMO users with respiratory failure (Table 1) [6].

The mass media, such as newspapers and the Internet, can have a substantial influence on the public’s attitudes and behaviors. For example, newspapers and the Internet provide readers with information on advances in medical technology, and the use of life-supporting treatments (LST). The information in newspapers and on the Internet may thus influence the decision-making of patients/family members regarding the request for an aggressive LST such as ECMO [9].

The purpose of our study was to examine the portrayal of ECMO use by Taiwan’s four major newspapers and the Internet web pages written in traditional Chinese. The specific aims were to: (1) quantify the coverage of ECMO use on newspapers and the Internet; (2) describe the characteristics of ECMO users presented in newspaper articles and the Internet web pages in comparison with those shown in ECMO studies in Taiwan; and (3) determine the survival rates of ECMO users presented in newspaper articles and the Internet web pages in comparison with those in ECMO studies in Taiwan and in the ECLS 2014.

Methods

Selection of stories

Some ECMO patients were featured in newspapers only (patients in newspapers), or on the Internet only (patients on the Internet). Those both featured on newspapers and the Internet were patients both in newspapers and on the Internet. Patients were defined as the ECMO patients either reported in newspapers or in the Internet. Therefore, patients are equal to the total of patients in newspapers, patients on the Internet, and patients both in newspapers and on the Internet.

Table 1 Studies conducted in Taiwan for reporting the survival rates for extra-corporeal membrane oxygenation use

| Location | Primary reason | Age (Mean ± SD) | Gender (F/M) | Alive/Dead at hospital discharge | Survival rate |
|----------|----------------|-----------------|--------------|---------------------------------|---------------|
| A        | CF             | 51.8 ± 20.5     | 30/104       | 57/77                           | 42.50%        |
|          | RF             | NA              | NA           | NA                              | NA            |
| A        | CF             | 29.7 ± 18.7     | 46/29        | 48/27                           | 64%           |
|          | RF             | NA              | NA           | NA                              | NA            |
| A        | CF             | 47 ± 2 a        | 40/62        | 36/44                           | 45%           |
|          | RF             | NA              | NA           | NA                              | NA            |
| B        | CF             | 42.3 ± Unknown a | 5/35         | 21/19                           | 52.50%        |
|          | RF             | NA              | NA           | NA                              | NA            |
| B        | CF             | 63.0 ± 15.7     | 15/36        | 17/34                           | 33.33%        |
|          | RF             | NA              | NA           | NA                              | NA            |
| C        | CF             | 56.8 ± 15.9     | 28/48        | 20/52                           | 27.78%        |
|          | RF             | NA              | NA           | NA                              | NA            |

Abbreviations list: CF cardiac failure, RF respiratory failure, SD standard deviation, F/M female/male, NA not applicable, A medical center A, B medical center B, C medical center C.  
aThe values were the median of patients’ ages.
A newspaper article describing a case of ECMO patient was a story in newspaper. An Internet web page describing a case of ECMO patient was a story on the Internet. Each single patient in newspaper or patient on the Internet could appear in several newspaper articles and Internet web pages, thus resulting in numerous stories in newspapers and stories on the Internet (Figure 1).

All issues of Taiwan’s four major newspapers, the Liberty Times, the Apple Daily, the China Times and the United Daily News, from 2006 to 2010, were searched and reviewed, and the headlines and texts of the newspaper articles on ECMO use were counted as a story in newspaper. In October 2011, a search of Internet web pages was performed using “yeh-ko-mo” (ECMO in traditional Chinese medicine), “ECMO,” and “extra-corporeal membrane oxygenation” as search terms. Each single Internet web page recounting ECMO use was counted as a story on the Internet.

Data collection
For each story on the Internet and story in newspaper, the following information was collected: age, sex, the location of the hospital of ECMO use (rural or urban area), the level of the hospital (medical center or non-medical center, as classified by Taiwan Joint Commission on Hospital Accreditation), the duration of ECMO use, the duration of intensive care unit stay, the duration of hospital stay, the status at hospital discharge, and the primary reason for ECMO use.

Statistical analysis
The continuous variables of patients, patients on the Internet, patients in newspapers, stories on the Internet, and stories in newspapers were compared with those from studies on ECMO use in Taiwan published in journals indexed in the Sciences Citation Index [3-8], and the ECLS 2014 [1], using one-sample t-tests. The associations between the characteristics of patients and patients on the Internet, between patients and patients in newspapers, and between patients and stories, were evaluated using Student's t-tests or Chi-squared tests. The survival rates of patients, patients on the Internet, patients in newspapers, stories on the Internet, and stories in newspapers were compared with those derived from the ECMO studies in Taiwan and the ECLS 2014, using one-sample t-tests. All statistical analyses were performed using the software package STATA MP 11.0 for Windows PC.

Results
Comparison of characteristics
Overall, we collected 419 stories (83 patients): 237 stories (55 patients on the Internet) from the Internet web pages and 182 stories (60 patients on newspapers) from the newspaper articles (Figure 1 and Table 2). Thirty-two of the ECMO patients appeared both in the newspaper articles and on the Internet web pages. Of the 182 stories in newspapers (patients in newspapers) collected from the four major newspapers, 12 (4), 23 (7), 75 (22), 42 (16), and 30 (11) stories in newspapers (patients in newspapers) were from the years 2006, 2007, 2008, 2009, and 2010, respectively.

Because the average ages of the ECMO patients in the studies by Chen et al. and Chou et al. were unavailable [5,6], and because some of the ECMO patients in the study by Chen et al. were also included in the study by Chung et al., we excluded these two studies from our analyses. In the remaining four studies [3,4,7,8], the average age of the 336 patients was 49.70 years. Of these patients, 119 (35.42%) were women. The rates of survival to hospital discharge for the ECMO users ranged from 27.78% to 64%, with an average survival rate of 42.77%.

The average ages of the 419 stories and 83 patients were 31.34 (±21.77) years and 31.68 (±22.72) years, respectively. These ages were significantly lower than the average ages of the patients in the four studies (p < .01). We noted that 38.44% of the 419 stories and 36.71% of the 83 patients were women. These values showed nonsignificant differences from the percentages of women in the four studies.
Myocarditis (121 stories, 22 patients), acute respiratory distress syndrome (86 stories, 13 patients), and acute myocardial infarction (44 stories, 12 patients) were the three leading primary causes of the need for ECMO. Patients with longer durations of ECMO use, longer durations in an intensive care unit, or cardiac failure as the primary reason for initiating ECMO were likely to have a greater number of stories both in newspapers and on the Internet than other patients. The numbers of stories and patients surviving to hospital discharge were 311 (74.22%) and 58 (69.88%), respectively.

**Comparison of survival rates**
We compared the survival rate of the 83 patients with that of the 55 patients on the Internet and with that of the 60 patients in newspapers. We also compared the survival rate of the 55 patients on the Internet with that of the 237 stories on the Internet, and compared the
The survival rate of the 60 patients was significantly higher than that of the 83 patients (p < .01). Although the average survival rate of the 182 stories was 8.34% lower than that of the 83 patients, this difference was not statistically significant (p = .19). We identified that the Internet web pages were more likely to report a higher rate of survival to hospital discharge following ECMO use than newspaper articles.

We compared the survival rates of the 83 patients, 419 stories, 55 patients on the Internet, 60 patients in newspapers, 237 stories on the Internet, and 182 stories in newspapers with those of the patients in the ECMO studies in Taiwan and the ECLS 2014 (Figure 2). The average survival rate of the stories was significantly higher than the highest survival rate in the four studies and the ECLS 2014 (p < .01). Although the survival rate of the 83 patients (69.88%) was higher than the highest survival rate reported in Taiwan (64%), this difference did not achieve statistical significance (p = .25).
non-significant differences from the average survival rate of all ECMO patients (60%) reported in the ECLS 2014 ($p = .05$).

The survival rate of the 237 stories on the Internet was significantly higher than the survival rates reported in the ECMO studies in Taiwan ($p < .01$) and in the ECLS 2014 ($p < .01$). However, the survival rate of the 182 stories in newspapers was not significantly higher than the highest survival rate of ECMO use in Taiwan ($p = .50$), and the average survival rate of ECMO use for all patients in the ECLS 2014 ($p = .67$) (Figure 2 and Table 3).

The majority of the 419 stories and 83 patients were adult patients, whereas the majority of the patients from whom data were collected in the ECLS 2014 were neonatal patients. Therefore, we also compared the survival rates presented in newspaper articles and Internet web pages with those obtained from the literature.
with the average survival rate of the adult ECMO patients reported in the ECLS 2014 (Figure 2). The survival rates of the 419 stories and 83 patients were both significantly higher than the average survival rate of the adult ECMO patients (46.96%) reported in the ECLS 2014 ($p < .01$).

Discussion

Novel LSTs such as ECMO typically attract considerable media attention in Taiwan [9]. In this study, we investigated the medical information on ECMO use presented in newspapers and on Internet web pages. We identified that: 1) Internet web pages were more likely to reproduce or duplicate the survival of ECMO patients than newspaper articles; and 2) the survival rates for ECMO use reported in newspapers and on Internet web pages were both over-optimistic as compared to those published in journals and the ECLS 2014.

Media and life-supporting treatment

In 1996, Diem et al. investigated the depiction of CPR in three popular television medical dramas in the United States, and observed that the medical information, such as the immediate survival rate of patients who received CPR, provided to the public by the medical dramas was over-optimistic [10]. However, three other studies conducted to evaluate the CPR survival rates shown in television medical dramas failed to identify significant differences from the survival rates provided in the literature [11-13]. The findings of the present study, based on newspapers and Internet web pages, are consistent with Diem and colleagues’ findings from television medical dramas, in that medical information provided by newspapers and the Internet to the public is over-optimistic as indicated by the survival rate of the patients sustained using LST, and may mistakenly convince the public that an aggressive LST (such as CPR and ECMO) can rescue patients from all life-threatening conditions.

Although the portrayal of the survival of patients receiving aggressive LST on television medical dramas remains controversial, it is apparent that such media outlets can substantially influence the public [14-17].

A study by Moynihan et al. investigated the coverage of three medications in the US news, observing that 60% of the news stories reported the potential benefits of the medications, whereas 47% of the news stories reported the potential harms. The study concluded that the coverage of the three drugs focused predominantly on their benefits [18]. Bartlett et al. reported that medical journals generally provide equal coverage of the positive and negative results of medical research, whereas newspapers are more likely to publish the negative results [19]. For example, one study concluded that jogging is significantly associated with beneficial effects on health [20] and another study showed that the risk of acute myeloid leukemia is significantly increased in cockpit crews [21]. Newspapers would tend to report the results of the second study rather than the first. Our study results showed that the survival rate of the 60 patients in newspapers and 182 stories in newspapers were both significantly higher than the average survival rates in the four ECMO studies in Taiwan, which suggested that newspapers are likely to provide over-optimistic medical information on ECMO use as a LST.

For ECMO use shown on the Internet web pages, we found two ways that the medical information was over-optimistic: First, writers or bloggers of Internet web pages were more likely to select the alive ECMO users than the dead, as indicated by the significantly higher survival rate of the 55 patients on the Internet than the highest survival rates of ECMO use ($p = .01$) in the four studies in Taiwan; Second, writers or bloggers were more likely to reproduce or duplicate the alive ECMO users shown by other Internet web pages than the dead ECMO users, as indicated by the higher survival rate of the 237 stories on the Internet than that of the 55 patients on the Internet ($p = .31$). Writers or bloggers of the Internet web pages may not have particular interests in reporting, reproducing or duplicating optimistic outcomes of ECMO use. Instead, they may report, reproduce or duplicate stories of their own personal interests or those which are effective in attracting readers’ attention.

Medical decisions to request aggressive LST is frequently discussed in the field of medical ethics. Physicians assist with a patient’s or family member’s medical decision-making by providing medical information and suggestions based on scientific and humanistic principles, and with respect for patient autonomy. Patients usually make medical decisions depending on the medical information and suggestions given by the physicians, personal values, personal preferences, and past medical experiences [22]. Therefore, the over-optimistic survival rate of ECMO users reported by the newspaper articles and Internet web pages may potentially influence patients’ and family members’ personal values and personal preferences, thus encouraging them to request ECMO being performed on themselves or their relatives while death is imminent.

None of the laws associated with clinical practice in Taiwan (e.g., Physicians Act [23], Medical Care Act [24], Hospice Palliative Care Act [25]) forces physicians to provide aggressive LST which is considered inappropriate to patients even if patients/family members request them. Therefore, physicians theoretically can decline the request of inappropriate LST based on their professional judgment. However, if the family members are influenced by the over-optimistic survival rate of the inappropriate LST users reported in newspaper articles and Internet web pages, and thus strongly request the inappropriate LST to be performed on the patients,
physicians, usually in fear of litigation or the burdensome process of litigation [26,27], are more likely to perform that LST without carefully deliberating its clinical indications.

**Strengths and limitations**

This study evaluated the medical information on ECMO use presented in newspaper articles and Internet web pages. According to the 2010 Annual Report of Mass Media by Shih Hsin University College of Journalism and Communications [28], 97.3%, 74%, and 71.3% of adults in Taiwan, aged between 15 and 64, acquired health-related information by watching television, reading newspapers, and searching the Internet, respectively. Readers of the Liberty Times, the Apple Daily, the United Daily News, and the China Times constituted 16.9%, 15.9%, 7.7%, and 6.1% of Taiwanese people who read newspapers, respectively [29]. Medical information on ECMO use in the four major newspapers and on Internet web pages may, thus, influence a large proportion of the Taiwanese population.

Our study has two major limitations. First, our results might not be applicable to other newspapers in Taiwan and elsewhere in the world, or to other Internet web pages not using traditional Chinese language. Second, we obtained our data for analyses from newspapers in Taiwan and the Internet web pages. The stories of ECMO use reported by newspaper articles and Internet web pages might not contain all the variables we needed in this study. Therefore, some variables in this study inevitably had missing values.

**Conclusions**

Newspapers and the Internet have the potential to influence patients’ knowledge and attitudes toward medical decision-making by providing over-optimistic medical information through the following ways: First, the mass media tend to attract the public’s attention by reporting the positive outcome of an important breakthrough in clinical medicine; Second, the mass media tend to report patients who survive to hospital discharge, rather than those who die during hospital stay; Third, the survived patients and their stories are more likely to be duplicated in newspapers and on Internet web pages than those who die during hospital stay. Newspaper readers and Internet users may, therefore, mistakenly believe that ECMO can usually rescue patients from all life-threatening conditions. However, ECMO, similar to other aggressive LST such as CPR, is ethically appropriate to be initiated on patients with reversible diseases, not on those with irreversible diseases. Future research should examine the influence of the over-optimistic information provided by the two means of mass media on medical decision-making for requesting aggressive LST such as ECMO use, as well as the attitudes physicians have toward the use of inappropriate LST requested by patients with over-optimistic information provided via mass media.

**Abbreviations**

CPR: Cardiopulmonary resuscitation; ECMO: Extra-corporeal membrane oxygenation; ECLS: Extracorporeal Life Support Registry Report International Summary for January 2014; LST: Life-supporting treatments.

**Competing interests**

The authors declare that they have no competing interests.

**Authors’ contributions**

YC (Chen YY) carried out the literature review, study design, statistical analyses, manuscript drafting, and manuscript editing. LC (Chen L) carried out the statistical analyses and manuscript editing. YK (Kao YH) helped with the literature review, data collection and data comparison. TC (Chu TS) helped with manuscript editing. TH (Huang TS) helped with study design and manuscript editing. WK (Ko WJ) participated in manuscript editing. All authors read and approved the final manuscript.

**Acknowledgement**

The authors would like to thank Taiwan Ministry of Science and Technology (99-2511-S-002-003-MY2 and 101-2511-S-002-010-MY3) and National Taiwan University Hospital (103-N2590) for partly supporting this study.

**Financial support information**

This study was partly supported by research grants from Taiwan Ministry of Science and Technology (99-2511-S-002-003-MY2 and 101-2511-S-002-010-MY3) and National Taiwan University Hospital (103-N2590).

**Author details**

1Department of Social Medicine, National Taiwan University College of Medicine, No. 1, Rd. Ren-Ai sec. 1, Taipei 10051, Taiwan. 2Department of Medical Education, National Taiwan University Hospital, No. 7, Rd. Chong-Shan S, Taipei 10002, Taiwan. 3Institute of Population Health Sciences, National Health Research Institutes, 35 Keyan Road, Zhunan, Miaoli County 35053, Taiwan. 4Department of Sociology, Iowa State University, 103 East Hall, Ames, IA 50011, USA. 5Department of Primary Care Medicine, National Taiwan University College of Medicine, No. 1, Rd. Ren-Ai sec. 1, Taipei 10051, Taiwan. 6Department of Internal Medicine, National Taiwan University Hospital, No. 7, Rd. Chong-Shan S, Taipei 10002, Taiwan. 7Department of Surgery, National Taiwan University College of Medicine, No. 1, Rd. Ren-Ai sec. 1, Taipei 10051, Taiwan. 8Department of Traumatology, National Taiwan University Hospital, No. 7, Rd. Chong-Shan S, Taipei 10002, Taiwan.

Received: 11 October 2013 Accepted: 10 July 2014 Published: 1 August 2014

**References**

1. Extracorporeal Life Support Organization: Extracorporeal Life Support (ECLS) Registry Report International Summary. Ann Arbor, MI: Extracorporeal Life Support Organization; 2014.
2. Taiwan Department of Health: In: News of the Messenger. Taiwan: Taiwan Department of Health; 2010.
3. Ko WJ, Lin CY, Chen RJ, Wang SS, Lin FY, Chen YS: Extracorporeal membrane oxygenation support for adult postcardiopulmomy cardiac shock. Ann Thorac Surg. 2002, 73(2):538–545.
4. Hsu PS, Chen JI, Hong GJ, Tsai YT, Lin CY, Lee CY, Chen YG, Tsai CS: Extracorporeal membrane oxygenation for refractory cardiogenic shock after cardiac surgery: predictors of early mortality and outcome from 51 adult patients. Eur J Cardiothorac Surg 2010, 37(2):328–333.
5. Chou NK, Chh NH, Wu JW, Huang SC, Chen YS, Yu HY, Tiao GJ, Ko WJ, Chu SH, Wang SS: Extracorporeal membrane oxygenation to rescue cardiopulmonary failure after heart transplantation: a single-center experience. Transplant Proc 2010, 42(3):943–945.
6. Chen YC, Tsai FC, Chang CH, Lin CY, Jenq CC, Juan KC, Hsu HH, Chang MY, Tian YC, Hung CC, Fang JT, Yang CW: Prognosis of patients on extracorporeal membrane oxygenation: the impact of acute kidney injury on mortality. Ann Thorac Surg 2011, 91(1):137–142.
7. Hsu KH, Chi NH, Yu HY, Wang CH, Huang SC, Wang SS, Ko WJ, Chen YS: Extracorporeal membrane oxygenation support for acute fulminant myocarditis: analysis of a single center’s experience. Eur J Cardiothorac Surg 2011, 40(3):682–688.
8. Chung SY, Sheu JJ, Lin YJ, Sun CK, Chang LT, Chen YL, Tsai TH, Chen CJ, Yang CH, Hang CL, Leu S, Wu C, Lee FY, Yip HK. Outcome of Patients With Profound Cardiogenic Shock After Cardiopulmonary Resuscitation and Prompt Extracorporeal Membrane Oxygenation Support. Circ J 2012, 76(6):1385–1392.

9. Chen YJ, Chen L, Huang TS, Ko WJ, Ni YH, Chang SC. Significant social events and increasing use of life-sustaining treatment: trend analysis using extracorporeal membrane oxygenation as an example. BMC Medical Ethics 2014, 15:21.

10. Diem SJ, Lantos JD, Tulsky JA. Cardiopulmonary resuscitation on television, Miracles and misinformation. N Engl J Med 1996, 334(24):1578–1582.

11. Gordon PN, Williamson S, Lawler PG. As seen on TV: observational study of cardiopulmonary resuscitation in British television medical dramas. BMJ 1998, 317(7161):782–783.

12. Van den Bulck J, Damiens K. Cardiopulmonary resuscitation on Flemish television: challenges to the television effects hypothesis. Emerg Med J 2004, 21(5):565–567.

13. Harris D, Willoughby H. Resuscitation on television: realistic or ridiculous? A quantitative observational analysis of the portrayal of cardiopulmonary resuscitation in television medical drama. Resuscitation 2009, 80(1):1275–1279.

14. Gibbon JH Jr. The development of the heart-lung apparatus. Am J Surg 1978, 135(5):608–619.

15. Gibbon JH Jr. Memoir of J. Parsons Schaeffer 1878–1970. Trans Stud Coll Physicians Phila 1971, 38(4):249–251.

16. Moynihan R, Bero L, Ross-Degnan D, Henry D, Lee K, Watkins J, Mah C, Somerera SB. Coverage by the news media of the benefits and risks of medications. N Engl J Med 2000, 342(22):1645–1650.

17. Baer NA. Cardiopulmonary resuscitation on television, Exaggerations and inaccuracies. N Engl J Med 1996, 334(24):1604–1605.

18. The collaborative UK ECMO (Extracorporeal Membrane Oxygenation) trial: follow-up to 1 year of age. Pediatrics 1998, 101(4):E1.

19. Bartlett C, Steen J, Egger M. What is newsworthy? Longitudinal study of the reporting of medical research in two British newspapers. BMJ 2002, 325(7355):81–84.

20. Schnohr P, Parner J, Lange P. Mortality in joggers: population based study of 4,658 men. BMJ 2000, 321(7261):602–603.

21. Gundestrup M, Storm HH. Radiation-induced acute myeloid leukaemia and other cancers in commercial jet cockpit crew: a population-based cohort study. Lancet 1999, 354(9195):2029–2031.

22. Brett AS. Inappropriate requests for treatments and tests. In 20 COMMON PROBLEMS-Ethics in Primary Care. Edited by Sugarman J. New York: The McGraw-Hill Companies, Inc, 2003–12.

23. Laws & Regulations Database of the Republic of China: Physicians Act. http://law.moj.gov.tw/Eng/LawClass/LawContent.aspx?PCODE=L0020021 (Accessed on June 16, 2014).

24. Laws & Regulations Database of the Republic of China: Medical Care Act. http://law.moj.gov.tw/Eng/LawClass/LawContent.aspx?PCODE=L0020021 (Accessed on June 16, 2014).

25. Laws & Regulations Database of the Republic of China: Hospice Palliative Care Act. http://law.moj.gov.tw/Eng/LawClass/LawContent.aspx?PCODE=L0020021 (Accessed on June 16, 2014).

26. Roy AD, Chen L, Santucci K. What do pediatric residents know about malpractice? Pediatr Emerg Care 2011, 27(7):586–590.

27. Burkle CM, Martin DP, Keegan MT. Which is feared more: harm to the ego or financial peril? A survey of anesthesiologists’ attitudes about medical malpractice. Minn Med 2012, 95(9):46–50.

28. Shih Hsin University College of Journalism and Communications: The 2010 Annual Report of Mass Media. http://www.shadowgov.tw/41299_0_is.htm (Accessed on June 16, 2014).

29. The Liberty Times: The Audit Bureau of Circulation audited the circulation in March 2010. http://www.libertytimes.com.tw/2010/new/may/25/today-life1.htm (Accessed on June 16, 2014).

Submit your next manuscript to BioMed Central and take full advantage of:

- Convenient online submission
- Thorough peer review
- No space constraints or color figure charges
- Immediate publication on acceptance
- Inclusion in PubMed, CAS, Scopus and Google Scholar
- Research which is freely available for redistribution

Cite this article as: Chen et al. The over-optimistic portrayal of life-supporting treatments in newspapers and on the Internet: a cross-sectional study using extra-corporeal membrane oxygenation as an example. BMC Medical Ethics 2014, 15:59.