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Quality and clarity of health information on Q&A sites

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Abstract

This study investigated the quality and clarity of health information from a total of 238 (126 English and 112 Chinese) answers retrieved from Yahoo! Answers sites. Registered nurses and library professionals judged information quality based on 8 criteria: accuracy, completeness, relevance, readability, verifiability, professional advice, usefulness and non-commercialization. Writing clarity was assessed through rhetorical structure analysis. Results showed that 46% of answers were of poor quality. Furthermore, many Q&A site users were unable to distinguish adequately between high- and low-quality answers. Only 60% of their selected best-answers corresponded to those of the health professionals. These results indicate that the reliability of health information on Q&A sites is questionable. This unreliability may partially be due to the fact that Q&A site answers contain both medical information and social support. Although both are important, they are not always compatible. It may even be dangerous to mistakenly present social support as objective medical information. This research suggests that medical advice and social support should be separated. This has a further advantage in that medical advice could be subjected to stringent, necessary quality assurance measures, without interfering with social support.

1. Introduction

Online question-and-answer (Q&A) sites have become popular means of health information exchange (Chan, 2015; Fox & Duggan, 2012). Since online information is more accessible than inconvenient, time-consuming visits to the doctor, people increasingly seek health information online (Fox & Jones, 2009; Leung, 2008; Nicholas, Huntington, Jamali, & Williams, 2007; Renahy, Parizot, & Chauvin, 2010). A survey of over 3600 people in the US found that 61% of adults consumed online health information (Fox & Jones, 2009). Some people even view online information services as reliable alternative diagnostic tools that can replace consultations with health professionals (Fox & Duggan, 2012). However, this trend of increasing self-reliance might have a significant drawback. In the absence of supervision by health professionals, it is unclear whether people are able to select accurate health information by themselves.

2. Problem statement

There are a number of reasons to doubt whether online health information searches yield desirable results. For example, the survey by Fox and Jones (2009) showed that 3% of respondents knew someone who had been harmed after following online medical advice. One reason why these accidents happen might be that people who provide answers on Q&A sites are not necessarily medically qualified (Gazan, 2011). This calls into question whether the information on Q&A sites is always correct and clearly written. Furthermore, Q&A site users seem to have trouble distinguishing between high and low accuracy answers. They tend to overestimate the quality of answers (Oh & Worrall, 2013; Oh, Worrall, & Yi, 2011; Oh, Yi, & Worrall, 2012) and base their ratings on socio-emotive rather than factual content (Kim, Oh, & Oh, 2007). These issues indicate possible problems with the quality of online information and with users' ability to identify and select reliable information.

In addition to the above-mentioned negative aspects of online health information, it may be noted that, compared to other topics, health information has an exceptionally low margin of error. Famous historical examples are King George III (1738–1820) of Britain, who reportedly ingested daily doses of poison on the advice of his doctors, and Emperor Jiajing (1507–1567) of China, who may have died after drinking what he believed to be “the elixir of life” but which was in fact was a mixture containing a high concentration of mercury. Even though, thankfully, the consequences of errors are not always lethal, providers of health information should aspire to be nothing less than accurate and crystal clear. The percentage (3%) of respondents reported by Fox and Jones (2009) who personally knew someone that had been harmed after following online medical advice is therefore not negligible. It is critical to investigate potential threats to online health information quality further so that information quality can be maintained and potentially improved.

The current study investigated two major issues with respect to online health information.

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First, it assessed the information quality and writing clarity of online Q&A health information. Health professionals rated the quality of Q&A answers based on 8 criteria, and two independent raters used rhetorical structure analysis (Mann & Thompson, 1988) to assess writing clarity. Second, the study investigated users' ability to select correct health information. This ability was assessed through the degree of agreement between users' and experts' selected best answers.² Given the lack of medical accreditation requirement, it was expected that Q&A health information would not meet the stringent quality standards to which health information should normally adhere. Furthermore, it was expected that users would not consistently be able to match the health professionals' choice of best answers.

3. Literature review

Health information needs to meet two criteria. First, it needs to be of high quality (Adams, 2010; Eysenbach, Powell, Kuss, & Sa, 2002; Williams, Nicholas, Huntington, & McLean, 2002), and second, the writing needs to be clear (Rieh & Danielson, 2007). If health information is of low quality, or if consumers cannot understand it, then it is unlikely to benefit patients.

3.1. Information quality

Different definitions of information quality exist. A systematic review of health information articles conducted by Eysenbach et al. (2002) found that concepts such as accuracy, completeness, readability and references provided were used as criteria to evaluate online health information. Adams (2010) mentioned similar criteria, such as authorship, trustworthiness, credibility and accuracy, completeness and non-commercialization. Williams et al. (2002) focused on reliability, accuracy, authority of sources, and disclosure of authors. Oh et al. (2011) and Zhu, Bernhard, and Gurevych (2009) included a range of criteria: accuracy, completeness, relevance, objectiveness, source credibility, readability, politeness, confidence, empathy and efforts. Other studies used fewer information quality dimensions, for instance, accuracy and disclosure statements (Eysenbach & Köhler, 2002); accuracy, completeness and verifiability (Fichman, 2011); and logic, verifiability, accuracy and expertise (Harper, Moy, & Konstan, 2009; Kim, 2010). After accounting for the overlap in these different definitions, 8 unique dimensions of information quality emerge: accuracy, completeness, relevance, readability, verifiability, professional advice, usefulness and non-commercialization. In this study, information quality was operationalized based on these 8 dimensions.

3.2. Writing clarity

Writing clarity is determined based on how texts are organized. Rhetorical structure theory

This is a preprint of an article accepted for publication in Library and Information Science Research. Chu SKW, Huang, H., et al. (in press, 2018). Quality and clarity of health information on Q&A sites (RST; Mann & Thompson, 1988) helps reveal this organization by breaking texts down into their constituent parts and their interrelations. The presence of interrelations indicate coherence and therefore clarity. For example, a coherent text is easier to understand than one that is merely a collection of unrelated statements. Abrahamson and Rubin (2012) employed RST to investigate differences in text structure between health information provided by health professionals and that provided by laypeople. By counting the frequency of RST elements, they found that whereas professionals mainly provided objective information to the reader, laypeople were more likely to urge readers to take specific actions. Recently, Green (2010) used an adapted version of RST to examine discourse and argument structures in patient letters. These examples show that it is possible to use RST to analyze healthcare related texts.

2.1. Q&A site users' ability to select appropriate information

Besides Abrahamson and Rubin (2012), other studies suggest that laypeople have substantially different ways of searching and evaluating medical literature compared to experts. Abrahamson, Fisher, Turner, Durrance, and Turner (2008) investigated obstacles encountered by online health information seekers. Results revealed that compared with experts, laypeople had more difficulties (1) understanding medical jargon and health information, and (2) asking further questions for clarification. Oh and colleagues (Oh et al., 2011; Oh et al., 2012; Oh & Worrall, 2013) compared the differences between the ratings of Q&A site health information given by laypeople and health professionals. They found that laypeople tended to overestimate the quality of health information in comparison with the ratings given by health professionals. Furthermore, Kim et al. (2007) examined the criteria that experts and laypeople used to rate the quality of health information. They discovered that laypeople were influenced more by socio-emotive than by factual content compared with experts. These results indicate that consumers of online health information use different criteria to evaluate information than medical experts.

The social aspects of online health information exchange are valuable as long as they do not interfere with people's ability to select accurate information. By analogy, it can be valuable to have a conversation while driving, as long as it does not become a distraction. This study investigates whether laypeople are able to distinguish between high and low quality answers without sufficient medical knowledge or advice from a health professional.

No study has directly investigated the correspondence between the quality ratings of laypeople and experts. To understand this point, it is necessary to distinguish between correspondence and mean difference. Whereas correspondence refers to the correlation between the variances of multiple raters, mean difference refers to the difference between the mean ratings of two groups of raters. There is not necessarily a relationship between these two concepts. A rater might provide significantly higher

This is a preprint of an article accepted for publication in *Library and Information Science Research*. Chu SKW, Huang, H., et al. (in press, 2018). Quality and clarity of health information on Q&A sites ratings than another and the two may still show a high correspondence. It might therefore be that laypeople show a high correspondence with experts even though laypeople lack expertise (Abrahamson et al., 2008), provide more naive quality ratings (Oh et al., 2011; Oh et al., 2012; Oh & Worrall, 2013) and are more influenced by emotionally charged content (Kim et al., 2007).

2.2. Research population

Geriatric patients and their caregivers were the target population for the study. According to a report by the United Nations (2013), the world population is experiencing a significant increase in ageing, which is accompanied by increased health care demands. A significant number of online, health related information searches are therefore geared towards geriatric patients. Furthermore, due to the comparatively low digital literacy of the elderly (Schäffer, 2007), caregivers are often the ones that carry out their online searches (Fox & Jones, 2009; Leung, 2008; Nicholas et al., 2007; Renahy et al., 2010). The current study therefore focused on Q&A site answers given in response to 238 questions posted by caregivers of geriatric patients.

3. Methodology

3.1. Ethics

Prior to data collection, formal ethical approval was provided by the Faculty Research Ethics Committee, The University of Hong Kong.

3.2. Data collection

Data was collected from a total of four English and three Chinese Yahoo! Q&A sites. For each language, 30 questions were sampled. The 30 Chinese questions were taken from Hong Kong ($n = 10$), Mainland China ($n = 10$) and Taiwan ($n = 10$), and the 30 English questions came from Australia ($n = 8$), Canada ($n = 7$), UK & Ireland ($n = 8$) and the US ($n = 7$). Since multiple answers could be provided to a single question, a total of 112 Chinese and 126 English answers were collected.

Inclusion of questions was determined according to four criteria: the question needed 1) to be related to geriatric health, 2) to be posted by a caregiver, 3) to consist of a minimum of 2 independent answers, and 4) to be marked as being resolved. Relevant questions were searched by first using the keywords “elderly,” “grandmother,” and “grandfather.” The search was then refined by selecting only answers posted under the “Health” category and excluding all questions having fewer than 2 answers provided or being marked as unresolved. Lastly, questions were selected if the wording of the question indicated that it was posted by a caregiver.

3.3. Measures

3.3.1. Information quality and writing clarity

A registered nurse and library professional fluent in English and Chinese judged the information quality of each Q&A answer based on the rubric provided in Table 1. Each information dimension was given a score between 1 and 3. As recommended by Miles and Huberman (1994), 20% of these ratings were compared with those of a second rater, who was also a registered nurse and library professional fluent in both English and Chinese. The inter-rater agreement (Cohen's kappa) for this sample was 83%.

Writing clarity was judged using RST (Mann & Thompson, 1988). In RST, each clause of a sentence is seen as an elementary discourse unit (EDU). Based on its relation to its surrounding EDUs, each EDU is labeled as either a nucleus, which is the main point of text, or a satellite, which is a supplementary text that augments or refers to the nucleus and cannot stand alone. There are 24 possible nucleus-satellite relations (Table 2). In this way, RST allows the numbers of nuclei, satellites and each type of relation to be quantified within a text. Fig. 1 shows a schematic example of how RST might be used to identify all relationships in a text. Based on this classification, writing clarity was operationalized as the number of relationships between nuclei and satellites. Texts that contain more relations are more coherent and are therefore deemed to be clearer than those texts that consist of unrelated clauses.

3.3.2. Q&a site users' ability to select appropriate information

In order to investigate whether Q&A site users were able to select the best available information without any help from a health professional, the correspondence between the users' selected best answers and the quality ratings was examined. Based on the quality ratings, a list of health professionals' selected best answers was composed, which consisted of answers that had been given the highest rating for each question. This list was then compared with the best-answer selections of Q&A site users.

3.3.3. Data analysis

Information quality. Information quality was analyzed by dividing the quality ratings into three different groups: poor, fair or good. Answers with a score between 8 and 11 were marked as poor. Those with a score between 12 and 17 that had 4 or more dimensions with a score of 1 were also marked as poor. Answers with a score between 12 and 17 that had fewer than 4 dimensions with a score of 1 were marked as fair, as were those with a score of 18 or more that had at least one dimension with a score of 1. Good answers were those with scores over 18 and no dimension with a score of 1. Cohen's kappa (κ) was computed to compare the prevalence of each answer category to a random, equal distribution of one-third of the answers in each category.

3.3.4. *Information quality and writing clarity*

The association between information quality and writing clarity ratings was analyzed via Spearman's rank order correlation (r_s).

3.4. *Q&A site users' ability to select appropriate information*

The correspondence between the best-answer selections of users and health professionals was determined based on the ratio between the total number of Q&A answers and the number of times both experts and laypeople selected the same best answer. The statistical significance of this relationship could not be examined using standard statistical tests.³ To resolve this issue, in line with Agresti (1992) and Uebersax (1992), a modelling approach was adopted. Matlab version 2012a was used to simulate 100 million lists containing randomly chosen best-answer selections for each of the 60 questions. By comparing these lists to the list of experts' choices, one could infer whether the actual correspondence between experts and users was different from chance. Furthermore, this approach allowed for the computation of an alternative κ – albeit not a conventional Cohen's κ . This kappa statistic is a function of empirical and expected random correspondence.⁴

The modelling approach further afforded a breakdown of the observed agreement between users and experts into *true* and *coincidental* agreement. True agreement was defined as the agreement that occurred because the users truly shared the same opinion as the experts on a question. Coincidental agreement was defined as agreement whereby the users did not share the same knowledge as the experts but just happened to select the same answer. Observed agreement was the sum of true and coincidental agreement.

True and coincidental agreement were determined as follows. All possible levels of true agreement were determined—that is, 0 to 60 answers. First, for each of these possible levels of true agreement, truly correct answers were assigned to a corresponding number of randomly chosen questions. For the remaining questions, 10 million lists of randomly chosen answers were assigned. These lists contained different levels of coincidental agreement. By adding the true and coincidental agreement in each list, the total agreement was determined for each individual list. Based on the total agreement of all 10 million lists given a certain level of true agreement, the 95% confidence interval of the total agreement could accurately be estimated. It could thus be inferred whether the observed agreement between experts and novices fell within the 95% confidence interval of total agreement given all possible levels of true agreement.

5. Results

5.1. Information quality

Results of information quality showed that 46% (N = 108) of the answers on the Q&A sites were of poor quality. This was the most prevalent rating ($\kappa = 0.19$, $p < .001$) as the percentage of fair and good quality answers was the same – both 27% (N = 64), ($\kappa = -0.08$, $p < .05$).

5.2. Information quality and writing clarity

Spearman's rank order correlation revealed a small positive association between information quality and writing clarity ($r_s = 0.21$, $p < .01$).

5.3. Q&A site users' ability to select appropriate information

In 60% (N = 36) of the cases, both the health professionals and the Q&A site users agreed on the answers that should receive the highest quality ranking, while in 40% (N = 24) of the cases they did not. This correspondence was significantly higher ($\kappa = 0.43$, $p < .001$) than chance (M = 17.73, SD = 3.43) as revealed by the simulation of best-answer selections.

The 60% observed agreement between users and experts indicated a true agreement between 30% (N = 18) and 53% (N = 32). A true agreement of 30% translates into an average of 51% (N = 30.4) total agreement (SD = 2.9, 95% CI = [24.6 36.2]). A true agreement of 53% translates into 67% (N = 40.3) total agreement (SD = 2.3, 95% CI = [35.7 44.9]). The closest correspondence between observed and total agreement was reached by a true agreement of 43% (N = 26), which translates into a total agreement of 36.2% (N = 36.1, SD = 2.6, 95% CI = [30.9 41.3]).

6. Discussion

Results indicated that a significant 46% of Q&A answers were of poor quality, which implies that health information on online Q&A sites is not very reliable. Furthermore, writing clarity significantly predicted information quality, thereby indicating that the lack of quality was partly due to a lack of writing clarity. As a result of these shortcomings, Q&A site users were hardly able to match the experts' best-answer selections. In only 60% of the cases did they select the same answers as those of the experts. At first glance, 60% might not seem very bad. However, to put it into perspective, one might imagine a doctor who gives wrong medical advice to 4 out of every 10 patients – an unacceptable situation! Additionally, the 60% observed correspondence consisted of about 43% true, shared knowledge between the users and experts. The other 57% of best-answer selections might just as well have been selected at random. These results indicate that health information on Q&A sites is not very reliable, and that users of Q&A sites are mostly unable to identify the most reliable answers without help from a health professional.

At first glance, the results of this study might look rather worrying. Especially so when coupled with the knowledge that people have been harmed after following online medical advice (Fox & Jones, 2009). However, the results also show the potential value of health information on Q&A

This is a preprint of an article accepted for publication in *Library and Information Science Research*. Chu SKW, Huang, H., et al. (in press, 2018). Quality and clarity of health information on Q&A sites and suggest how this value might be cultivated. First of all, the results show that users do share some—albeit lit- tle—knowledge with health professionals. This means that even though not entirely reliable by itself, the information may have some value if used appropriately. For example, patients might browse Q&A sites as an accessible way to familiarize themselves with symptoms and illnesses. Knowledge gained through these searches should not be taken as fact

but should be verified with a health professional. In some instances, this manner of online Q&A activity has even reportedly saved lives. For example, an article in the *Daily Mail* (Edwards, 2014) reported the story of a man who decided to consult a doctor and was diagnosed with testicular cancer after reading a post on the social media website Reddit. The man said, “I went to the comments and was reading through and [read about] about symptoms and what not... it was like, wait, I have something similar to this”. Some cases have reportedly led to the discovery of rare diseases, such as Cushing's disease (Castillo, 2012) and rhabdomyolysis (“Extreme Soreness,” 2014). These ex- amples clearly show how potentially unreliable information can be useful when verified with a health professional.

Furthermore, the results of the current study corroborate Hartzler and Pratt's (2011) suggestion that, besides the need for accurate in- formation, patients require social and emotional support. For example, one of the users' best-answer selections was:

“Sorry to hear about your dear old ma. It is sometimes better to avoid taking all those tablets and simply allow nature to take it's (sic) course. Because they can seriously interfere with one's quality of life. Let her decide what she wants to do. Give her a big hug from us all here at ya.”

While this answer might serve to fulfill a need for emotional sup- port, it received a very poor quality rating from the health profes- sionals.

Even though not always correlated with information quality, emo- tional support is an important factor underlying health. A number of studies (Berkman, Leo-Summers, & Horwitz, 1992; Butler, Classen, & Speigel, 1999; Hallaråker, Arefjord, Havik, & Mæland, 2001; Kulik, 1993; Leifheit-Limson et al., 2012) have shown that social support plays an important role in health promotion and recovery from illness. Rea- sons for these positive effects might be the ability of social support to share experiences (Høybye, Johansen, & Tjørnhøj-Thomsen, 2005; Ziebland & Wyke, 2012) and improve the quality of self-monitoring and self-care (Maise & Maija, 2001; Tang, Brown, Funnell, & Anderson, 2008). Another benefit of social support is that it creates a large, freely accessible database that can be used to learn more about patients' needs and how health information can be tailored to fulfill these needs (Alpay, Blanson Herkemans, Otten, Rövekamp, & Dumay, 2010; Alpay, Verhoef, Xie, Te'eni, & Zwetsloot-Schonk, 2009). Future study is needed to investigate how the needs for social support and high-quality in- formation can be met simultaneously.

7. Limitations

Limitations of the current study are the fact that only the laypeople's best-answer selections could be extracted from the Q&A answer sites and that only posts by geriatric patients' caregivers were taken into account. Furthermore, writing quality was defined narrowly in terms of medical accuracy. Those seeking social support on online forums may use a different definition of quality, which may include more intangible factors such as empathy and credibility. Results of this study are therefore primarily applicable to people seeking accurate health in- formation. Future studies may replicate the current study with a dif- ferent population and apply

This is a preprint of an article accepted for publication in *Library and Information Science Research*. Chu SKW, Huang, H., et al. (in press, 2018). Quality and clarity of health information on Q&A sites: a more fine-grained measure of laypeople's quality ratings. Furthermore, since writing clarity partially governs information quality, future studies might investigate the effect of providing writing instructions on the quality of answers.

8. Conclusion

This study shows that information on online health related Q&A sites is not entirely reliable and clear, and for these (and other) reasons, Q&A site users might not be able to select the best available answer and identify correct information on online Q&A sites. These findings suggest that information professionals, health professionals, and others working with users of Q&A sites should make it clear that posts should not be regarded as reliable sources of accurate health information, and that users should be cautious when following recommendations provided on the Q&A sites and should verify online information with health professionals. This study also offers a methodology which may be of value for those wishing to pursue similar studies in other communities.

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Table 1

Rubric for determination of information quality.

Information quality dimensions	Poor = 1	Fair = 2	Good = 3	References
Accuracy	<u>No/ very limited</u> health info is provided/ contain misleading/ harmful/ wrong information	Without misleading/ harmful/ wrong information; may/ may not contain evidence-based information	Tend to be evidence-based and/ factual info and tend to be objective/ rational practice	Eysenbach et al. (2002); Kunst and Khan (2008); Oh et al. (2011); Rieh and Danielson (2007); Shachaf (2009)
Completeness	Only single limited aspect of questions to be addressed	Majority of aspects to be addressed/ discussed with/ without details	Provide detailed info & answer all aspects of the question	Abrahamson et al. (2008); Eysenbach et al. (2002); Fichman (2011).
Non-Commercialisation	Provide relevant info/ links/ contact details <u>in the purpose of selling</u> products/ services without much elaboration	Provide info <u>mainly</u> and/ provide reasonable explanation of why the <u>products/ services</u> could be helpful to improve situation(s)/ condition(s)	No evidence of selling products	Adams (2010); Gagliardi and Jadad (2002); Kunst and Khan (2008); Oh et al. (2011); Weitzman, Cole, Kaci, and Mandl (2011); Williams et al. (2002)
Relevance	Irrelevant info at all/ no/ little relevant information provided	Majority of information is relevant; may contain little amount of irrelevant information	All info. Provided is relevant for answering the question	Bliemel and Hassanein (2006); Oh et al. (2011); Stvilia, Mon, and Yi (2009); Zhu et al. (2009)
Readability	Cannot understand/ less understandable for layman/ poor expression/ poor presentation/ mainly duplicate information	Overall understandable but contain a few spelling and/ grammatical mistakes and/ improper wordings	Very easy to read/ logical development by paragraphs	Bliemel and Hassanein (2006); Childs (2004); Kim (2010); Marshall and Williams (2006); Oh et al. (2011); Zhu et al. (2009)
Verifiability	Little or no idea where the source(s) /information came from where the source(s)/information came from <u>but may not</u> be a reliable one	Personal/relatives' experiences with/without other reliable sources to support the answer	State clearly the source(s)/info based on including self-referencing and/provide external source(s) which is/are accessible and reliable	Fichman (2011); Gagliardi and Jadad (2002); Kim (2010); Marshall and Williams (2006); Oh et al. (2011); Rieh and Danielson (2007); Shachaf (2009); Stvilia et al. (2009); Williams et al. (2002)
Professional Advice	<u>No</u> professional advice provided/low level of professional advice	<u>Mainly</u> relatives'/patients' experience but with some professional advice to be <u>recalled</u> OR provide info that a health profession is most likely to provide in response to the question	Share/recall <u>mainly</u> professional advice by a <u>third person</u> OR <u>health professional(s)</u>	Abrahamson et al. (2008); Abrahamson and Rubin (2012); Bliemel and Hassanein (2006); Guada and Venable (2011); Kim (2010); Stvilia et al. (2009); Zhu et al. (2009)
Usefulness	Useless info./contain little useful info./ dead link (s) (all or majority) / potential wrong direction/ referrals given/ potential harmful practice	Overall useful information/ provide a sense of direction/ making correct referrals for seeking further info	Very useful information with strategic/ alternative plan(s) suggested/ problem-solving approach/ reliable practical information	Abrahamson et al. (2008); Kim (2010); Zhu et al. (2009)

Table 2
The nucleus-satellite relationships.

Rhetorical patterns		Definition	Data quality indications
Multi-nuclei	Contrast	Refers to no more than two units of nuclei that differ in some respects	Presents a situation that is different in some respects
Multi-nuclei	Joint	Refers to two or more nuclei of clauses that describe different aspects of a situation	Recognizes the non-succession relationships of a situation among the nuclei
Multi-nuclei	Sequence	Refers to two or more nuclei of clauses that describe a temporal relationship	Recognizes the succession relationships among the nuclei
Presentational relations	Background	The satellite allow the readers to comprehend the nucleus sufficiently	Answers increase the ability of readers to comprehend the nucleus
Presentational relations	Concession	Refers to a unit of text that has positive regard for the situation	Increases the positive regard of a situation presented in nucleus
Presentational relations	Enablement	Refers to a presentational relation that describes the unit(s) of text that can possibly increase readers' ability to perform action(s) presented – e.g., to suggest that a pharmacology textbook can be used to look up accurate information or justify the use of medications. In this case, the action is to justify the use of medications.	Questioners will feel their ability to perform the action(s) increased
Presentational relations	Evidence	Refers to a presentational relation which describes the unit(s) of text that provide scientific or non-scientific evidence or sharing cases.	Questioners do not recognize evidence
Presentational relations	Motivation	Refers to a presentational relation which describes the unit(s) of text that provide(s) encouragement or sharing positive experience to increase reader's desire to perform action presented in a nucleus.	Answerers encourage or comfort questioners to increase their desire to perform the actions
Presentational relations	Restatement	Refers to a presentational relation that describes unit(s) of text that repeats previous statement(s)	Answerers restate part of mentioned solution(s)
Presentational relations	Summary	Describes one or more units of text that restate a situation in a shorter manner	Recognizes the satellite as a shorter restatement of the nucleus
Subject matter relations	Circumstance	Refers to a subject matter relation which describes that unit of text that provide a framework to consider the subject matter more comprehensively, to interpret the situation further)	Recognizes the different possible situations, factors, or individual cases raised by the answers
Subject matter relations	Condition	Satellite presents a hypothetical, future, or otherwise unrealized situation	Recognizes how the realization of the situation presented in the nucleus depends on the realization of the situation presented in the satellite
Subject matter relations	Elaboration	Refers to a subject matter relation which describes the unit(s) of text that provide additional detail about the situation or some element of subject matter (Mann & Thompson, 1988) which is presented as abstract/ whole/generalization	Provide additional information elaborated from mentioned circumstances
Subject matter relations	Evaluation	Refers to a subject matter relation which describes the unit(s) of text that describes the degree of writer's positive or negative regard toward the situation (Mann & Thompson, 1988).	Answerers tell directly the degree of deterioration
Subject matter relations	Non-volitional cause	Nucleus presents a situation that is not a volitional action	Recognizes that the situation presented in the satellite is a cause of the situation presented in the nucleus
Subject matter relations	Non-volitional result	Satellite presents a situation that is not a volitional action	Recognizes that the situation presented in the nucleus could have caused the situation presented in the satellite
Subject matter relations	Otherwise	Presents an unrealized situation that is differs in some respects	Recognizes the dependency relation of prevention between the realization of the situation presented in the nucleus and the realization of the situation presented in the satellite
Subject matter relations	Solutionhood	Refers to a subject matter relation which describes unit(s) of text that provides solution(s) or practical approach(es) for solving or improving the subject matter.	Recognizes the situation presented in the nucleus as a solution to the problem presented in the satellite
Subject matter relations	Volitional cause	Nucleus presents a volitional action or a situation that could have arisen from a volitional action	Recognizes the situation presented in the satellite as a cause for the volitional action presented in the nucleus
Subject matter relations	Volitional result	Satellite presents a volitional action or a situation that could have arisen from a volitional action	Recognizes that the situation presented in the nucleus could be a cause for the action or situation presented in the satellite

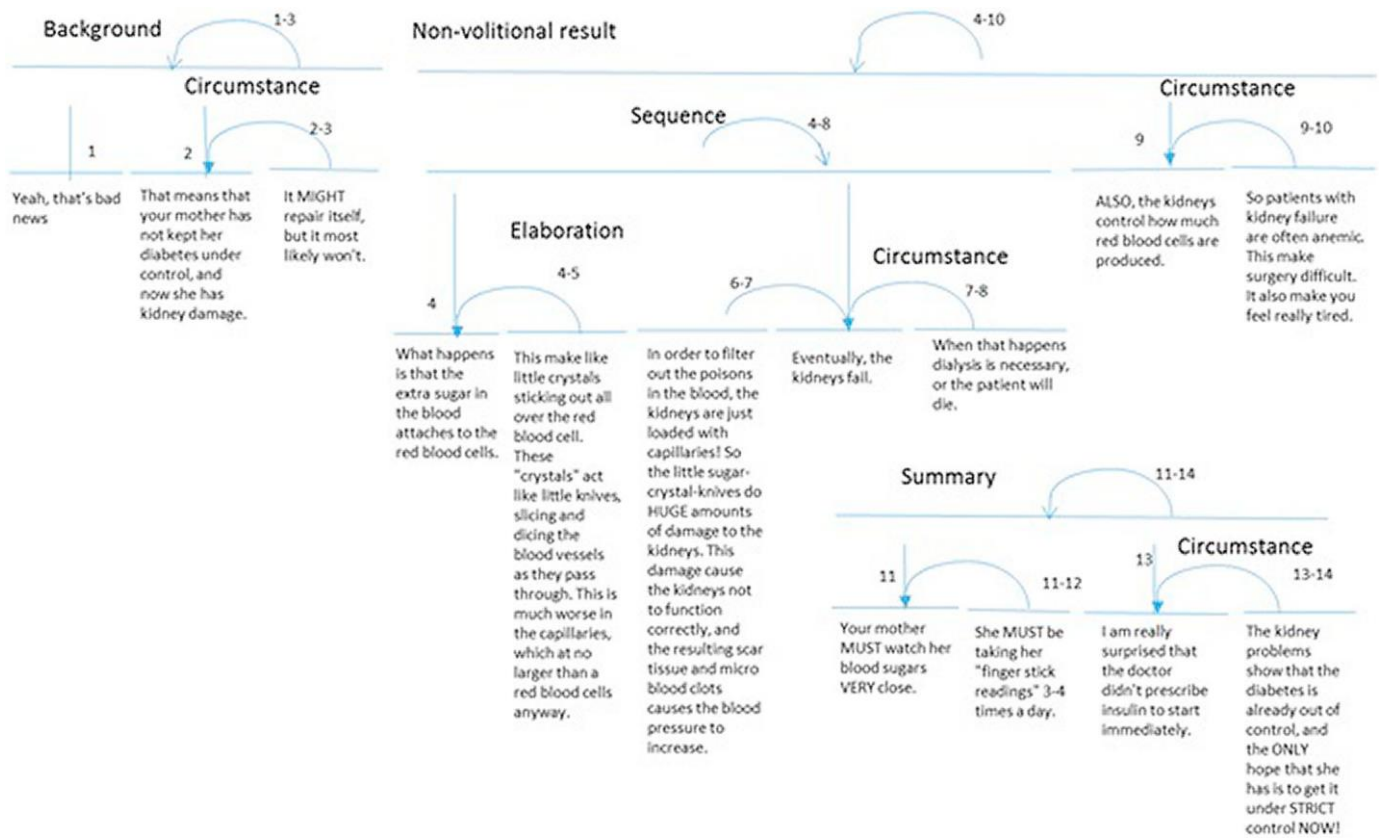


Fig. 1. An example of how RST might be used to identify nucleus-satellite relationships.