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ORIGINAL RESEARCH

Risk Judgment by General Dental Practitioners: Rational but Uninformed

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Abstract

Background: Decisions by dentists to administer antibiotic prophylaxis to prevent infectious complications in patients involves professional risk assessment. While recommendations for rational use have been published, several studies have shown that dentists have low adherence to these recommendations.

Objective: To examine general dental practitioners' (GDPs') assessments of the risk of complications if not administering antibiotic prophylaxis in connection with dental procedures in patients with specific medical conditions.

Methods: Postal questionnaires in combination with telephone interviews. Risk assessments were made using visual analogue scales (VAS), where zero represented "insignificant risk" and 100 represented a "very significant risk".

Results: Response rate: 51%. The mean risk assessments were higher for GDPs who administered antibiotics (mean = 54, SD = 23, range 26–72 mm on the VAS) than those who did not (mean = 14, SD = 12, range 7–31 mm) ($P < 0.05$). Generally, GDPs made higher risk assessments for patients with medical conditions that are included in recommendations than those with conditions that are not included. Overall, risk assessments were higher for tooth removal than for scaling or root canal treatment, even though the risk assessments should be considered equal for these interventions.

Conclusions: GDPs' risk assessments were rational but uninformed. They administered antibiotics in a manner that was consistent with their risk assessments. Their risk assessments, however, were overestimated. Inaccurate judgments of risk should not be expected to disappear in the presence of new information. To achieve change, clinicians must be motivated to improve behaviour and an evidence-based implementation strategy is required.

Keywords: antibiotic prophylaxis, decision making, judgment, risk assessment

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Introduction

Decisions by dentists about whether to administer antibiotic prophylaxis to prevent infectious complications in patients with specific medical conditions are dichotomous decisions. Before making a decision, dentists need to make judgments. Such judgments should include the risks associated with administering or not administering antibiotic prophylaxis. In medical science, risk can be defined as: "The probability that an event will occur. It encompasses a variety of measures of the probability of a generally unfavourable outcome".[1]

There is an element of risk inherent in clinical decisions.[2] The risks may include the probability of an infection if antibiotic prophylaxis is not administered, the probability of adverse events from antibiotics, and the probability of developing antibiotic resistance. The knowledge in the literature of these probabilities is limited[3,4] and thus there is uncertainty surrounding these decisions. Recommendations for the rational use of antibiotic prophylaxis have been published to provide support for these decisions, but most recommendations are based on consensus rather than scientific evidence. Several studies have shown that dentists present low adherence to recommendations,[5,6] and wide variations in general dental practitioners' (GDPs') administration strategies of antibiotic prophylaxis have been reported.[5,7,8] Our aim was to examine GDPs' assessments of the risk of complications if not administering antibiotic prophylaxis in connection with dental procedures in patients with specific medical conditions.

Methods

Setting and participants

A computer-generated randomization procedure selected 200 GDPs from two Swedish counties to participate in the study. The response rate was 51% (101/200). The GDPs were selected from the membership register of the Swedish Dental Association (which included approximately 88% of all licensed dentists in Sweden in 2003). The share of male respondents was 57% and of female respondents 43%. These distributions reflect the distributions of female and male dentists in the membership register of the Swedish Dental Association. The mean age of the respondents was 48 (range 26–64). The mean number of years of professional experience as GDPs was 20 (range 1–44). More respondents worked in the Public Dental Service (60%) than in private dental service (40%). The Ethics Committee at Lund University in Sweden approved the study (LU 305–02).

There were no significant differences between respondents and non-respondents regarding sex, age or place of work (public/private dental service) ($P > 0.05$), analyzed with the chi-square test. Thus, the group of respondents could be considered representative of the initial sample of GDPs who had been randomly selected for participation. To permit a further evaluation of the non-respondents, we constructed an abbreviated version of the questionnaire comprising three of the medical conditions and sent it to ten of the non-repondents.

In Sweden most dentists have access to recommendations about administration of antibiotic prophylaxis to patients with specific medical conditions. The recommendations also include which substance should be used and the appropriate duration of treatment. In the two Swedish counties included in this study, recommendations are distributed differently to the caregivers: on intranet, internet or as a document distributed through regular mail.

Data collection procedure

A postal questionnaire in combination with a structured telephone interview was used. The telephone interviews were used to increase the validity of the answers. Informed consent was obtained from all participants. The questionnaire and telephone interview method were described in detail in a previous study.[9] The present study is a part of a more extensive questionnaire study on GDPs' administration strategies and assessments of confidence in their decisions on antibiotic prophylaxis administration. Data were collected between January and June 2003.

The questionnaire comprised eight simulated cases of patients with different medical conditions, including conditions for which antibiotic prophylaxis might be considered when performing dental procedures[10–13]:

1. Type 1 diabetes mellitus, insulin-dependent, well controlled.
2. Type 2 diabetes mellitus, medicating with oral anti-diabetic agents, well controlled.
3. Type 1 diabetes mellitus, insulin-dependent, not well controlled.
4. Moderate hypertension, medicating with beta-receptor antagonist.

5. Myocardial infarction 3 months ago, medicating with ACE inhibitor, beta-receptor antagonist, low-dose aspirin, and simvastatin.
6. Kidney transplant 3 years ago, medicating with immunosuppressive and beta-receptor antagonist for moderate hypertension, well controlled without complications.
7. Heart valve prosthesis, medicating with warfarin.
8. Hip prosthesis, replacement performed 3 years ago.

For each medical condition, three types of dental procedures were presented:

a. Scaling lingually in the lower jaw (probing pocket depth between 2 and 3 mm).
b. Surgery, for example, removal of an asymptomatic tooth.
c. Root canal treatment due to pulp exposure as a result of caries (the pulp is vital).

These dental procedures were selected to represent interventions that could produce gingival bleeding. Root canal treatment (procedure C) *per se* is not generally a procedure that is considered to cause gingival bleeding and require antibiotic prophylaxis. But placement of rubber dam clamps may cause gingival bleeding and thus generate bacteremia.[14]

Apart from the information in the cases about gender, age, and otherwise healthy patients (see Fig. 1) we deliberately narrowed the information of the cases to focus on the medical condition and the dental procedure, which is the most important information that the GDPs should consider in the decision. This is also the information that recommendations are based upon.

For each case, the GDPs were asked to consider the questions presented in Figure 1. Each GDP's assessment of risk in a decision was measured to the nearest millimetre on a visual analogue scale (VAS) where 0 mm represented the end-point "insignificant risk" and 100 mm represented "very significant risk". Risk judgment is a cognitive process of GDPs' assessments on the VAS. Risk assessments are the quantification of these judgments.

Data analysis

Differences in risk assessments between GDPs who would administer antibiotic prophylaxis and those who would not were analyzed with the Independent Samples t-test. Differences in risk assessments between men and women, between GDPs working in the Public Dental Service and private dental service, and between GDPs with varying numbers of years of professional experience were analyzed using multiple linear regression. Statistical analyses were performed using SPSS (version 14). The level of significance was 0.05 in all statistical tests.

Results

Table 1 presents GDPs' administration of antibiotic prophylaxis and their assessments of the risk of complications if antibiotics are not administered. The results showed that the mean risk assessment was higher for GDPs who would administer antibiotics (mean = 54, SD = 23, range of means: 26–72 mm on the VAS), than those who would not (mean = 14, SD = 12, range of means: 7–31 mm) ($P < 0.05$). The only exception was for tooth removal in the patient with type 2 diabetes that is well controlled. Overall, the GDPs' risk assessment were higher for tooth removal than for scaling or root canal treatment. Among the GDPs who administered antibiotic prophylaxis, the highest risk assessments were for patients with medical conditions that are included in recommen-

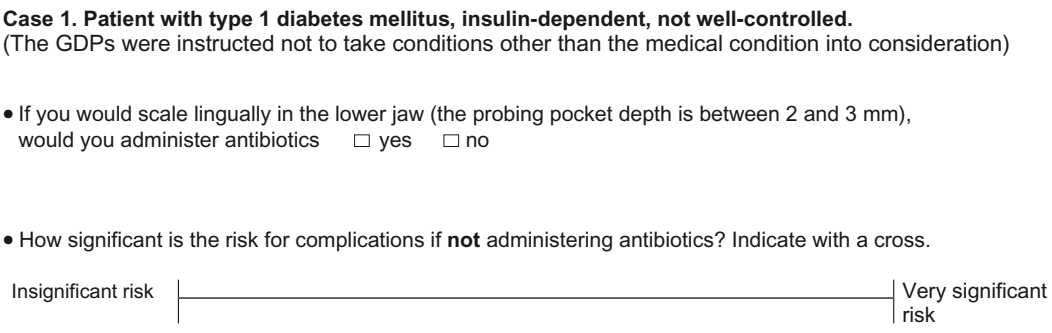

Figure 1. One of the cases presented to the GDPs.

Table 1. GDPs' (n = 101*) administration of antibiotic prophylaxis, their assessments of risk on the VAS and an analysis of differences in mean risk between GDPs who administered antibiotics and those who did not.

Medical condition	Dental procedure	Administer antibiotics		Risk mean (SD)		
		Yes	No	Yes	No	*P*
1. Type 1 diabetes, well-controlled	Scaling	–	101	–	7 (9)	‡
	Tooth removal	10	91	40 (16)	12 (10)	0.00†
	Root canal treatm.	1	100	46	7 (8)	‡
2. Type 2 diabetes, well-controlled	Scaling	–	101	–	7 (9)	‡
	Tooth removal	6	95	26 (18)	10 (9)	0.08
	Root canal treatm.	–	101	–	7 (9)	‡
3. Type 1 diabetes, not well-controlled	Scaling	30	71	54 (16)	16 (13)	0.00†
	Tooth removal	77	24	60 (17)	22 (13)	0.00†
	Root canal treatm.	22	79	55 (12)	17 (13)	0.00†
4. Moderate hypertension	Scaling	–	101	–	8 (8)	‡
	Tooth removal	1	100	57	10 (9)	‡
	Root canal treatm.	–	101	–	8 (8)	‡
5. Myocardial infarction	Scaling	28	73	65 (25)	15 (15)	0.00†
	Tooth removal	54	47	62 (24)	17 (15)	0.00†
	Root canal treatm.	24	77	55 (30)	17 (15)	0.00†
6. Kidney transplant	Scaling	50	46	59 (21)	14 (12)	0.00†
	Tooth removal	83	11	63 (23)	31 (16)	0.00†
	Root canal treatm.	39	56	52 (24)	19 (16)	0.00†
7. Heart valve prosthesis	Scaling	75	25	68 (25)	17 (13)	0.00†
	Tooth removal	97	1	72 (23)	25	‡
	Root canal treatm.	63	37	56 (27)	15 (15)	0.00†
8. Hip prosthesis, 3 years ago	Scaling	10	91	47 (32)	12 (12)	0.01†
	Tooth removal	41	60	48 (27)	16 (15)	0.00†
	Root canal treatm.	12	89	45 (28)	12 (12)	0.00†

*For some decisions, a few GDPs answered "would contact the patient's physician" (<101).
‡No statistical comparison was possible since there were no or too few GDPs in the yes or no groups.
†GDPs who would administer antibiotics assessed the risk higher than those who would not.

dations in Sweden[15–16] (i.e. not well controlled type 1 diabetes, kidney transplant and heart valve prosthesis) but also for myocardial infarction. The latter condition is not included in any recommendation. For these medical conditions, risk assessments were in the 52–72 mm range on the VAS. Among the GDPs who did not administer antibiotics, the highest mean risk assessments were in the 14–31 mm range on the VAS and were for the same medical conditions. Generally, there were no differences in risk assessments between men and women, between GDPs working in the Public Dental Service and private dental service, or between GDPs with varying numbers of years of professional experience ($P > 0.05$).

Discussion

GDPs' risk judgments

The GDPs' risk assessments were generally higher for patients with medical conditions that are included in recommendations than for those with conditions that are not. Risk assessments were also higher for tooth removal than scaling or root canal treatment. The GDPs were more inclined to administer antibiotics when their risk assessments were higher. In that sense, their decisions could be considered rational.

However, the GDPs appear to have generally overestimated the risk of complications. The potential complication in patients with heart valve implant is endocarditis. The estimated incidence of endocarditis in connection with dental procedures without antibiotic prophylaxis is 1 in 46 000.[17] Assessments of the risk of complications by GDPs who would administer antibiotic prophylaxis for the patient with heart valve prosthesis were in the 56–72 mm range on the VAS. The GDPs made high risk assessments in spite of the very low objective risk. Research has shown that the risks seen by people are often different from the actual risks.[18] Risk judgments by those seen as experts (for example, those who construct recommendations) focus more on probabilities and also

on potential complications[19] such as endocarditis. GDPs' risk judgments may focus more on potential complications such as endocarditis and their most severe possible outcomes (such as death) than on probabilities. Risks that have a low probability but high consequences, such as endocarditis that may lead to death, are often overestimated.[19] This could explain the GDPs' relatively high risk judgments. In Figure 2, a model has been constructed to illustrate possible differences in risk judgments made by experts and GDPs. Another explanation for the fact that GDPs tend to overestimate risk in these patients may be that cases of endocarditis have been reported to the Medical Responsibility Board in Sweden, after which clinicians have been reprimanded for their failure to administer antibiotic prophylaxis. That has been reported in journals, which may have caused GDPs to focus and overestimate the number of endocarditis cases and thus overestimate the risks. Recommendations (that are based on consensus and not on evidence) state that antibiotic prophylaxis is warranted for this medical condition, but it is an interesting finding that GDPs' risk assessments are highly overestimated. However, eventhough we consider that the GDPs overestimated the risk, since risk conceptually is the product of probability and utility of outcomes, it might simply be that they have high disutilites for the consequences. But it is plausible.

For the other medical conditions included in this study, the mean risk assessments by GDPs who administered antibiotic prophylaxis were in the 26–65 mm range on the VAS. There are several potential complications that GDPs may have in mind for these patients. Among them are serious complications such as late joint infections, kidney rejection, and sepsis, or mild complications such as local infections. The literature lacks scientific evidence for the use of antibiotic prophylaxis in patients with these medical conditions[4], and they are increasingly excluded from recommendations. However, many recommendations still include some of the conditions (such as not well controlled type 1 diabetes, kidney transplant and hip prosthesis) as potentially requiring antibiotic administration. Such recommendations are based on consensus rather than scientific evidence.

Decisions by clinicians are sometimes considered irrational if they have not been based on adequate information.[21] However, if their decisions are based on insufficient knowledge, they are not necessarily irrational. Among the GDPs who said they would administer antibiotic prophylaxis similar risk assessments were made for the patient with heart valve prosthesis and myocardial infarction, which indicate that GDPs lack knowledge about these medical conditions and the process of developing endocarditis which is not relevant for a patient with myocardial infarction. Overall, risk assessments by GDPs were higher for tooth removal than for scaling or root canal treatment. This indicates that these GDPs lack knowledge that

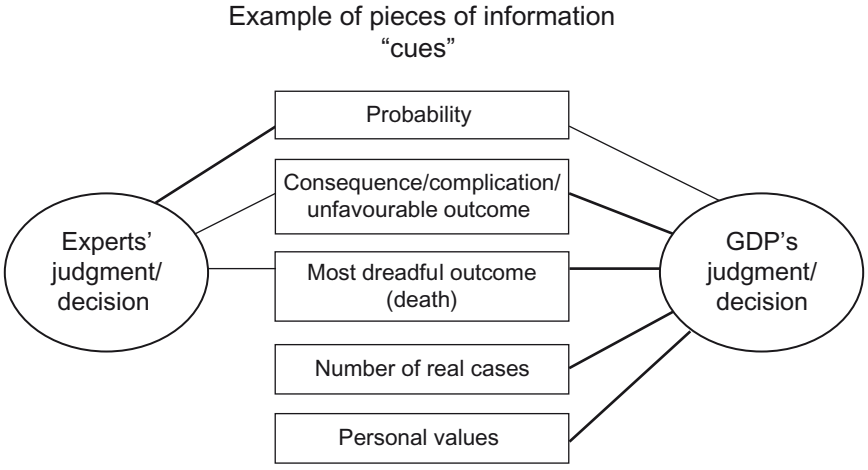

Figure 2. Model of risk judgment by experts vs. GDPs, modified by using the Social Judgment Theory: Brunswik's lens model.[20] The cues are the pieces of information considered in making the judgment/decision. The varying thicknesses indicate that the cues considered by a GDP in making a judgment/decision differ from those of the experts. Experts are here considered as those who develop recommendations.

bacteraemia occurs when gingival bleeding is present, independent of the procedure. Many common interventions in the oral cavity—including tooth brushing, scaling, and tooth removal—produce bacteremia.[14]

The evidence for the use of antibiotic prophylaxis has been questioned. The National Institute for Clinical Excellence (NICE) in the UK recently revised its recommendations and now states that antibiotic prophylaxis is not warranted for any cardiac conditions to prevent infective endocarditis.[22] Research indicates that inaccurate risk judgments should not be expected to disappear in the presence of new information, given that strong initial views are resistant to change and influence the way new information is interpreted.[18] People tend to regard new information as reliable if it is consistent with their previous beliefs and unreliable if it is inconsistent with those beliefs.[18] A previous study that we conducted suggested that GDPs tend to be very confident about their decisions concerning the administration of antibiotics.[9] Thus, it is reasonable to assume that new information may not have much of an impact on their assessments and decisions. Research has shown that risk judgments is correlated with both probabilities and evaluations of the severity of potential consequences.[23] However, the demand for risk reduction is strongly related to the estimated severity of consequences and very weakly related to the probability.[23] This suggests that people will not be influenced very much by probability data or by statements that the risks are small.[19] Having the capacity to change implies that the clinician has insight into personal weaknesses and that motivation to improve behaviour is present.[24] Furthermore, an evidence-based implementation strategy is required.[25–26]

Limitations

The 51% response rate in our study can be compared to the response rates of 20–60% reported in similar studies.[7,8,27] One reason for the rather low response rate may be that the method of collecting answers—a questionnaire and a telephone interview—was considered time-consuming for the respondents. Nevertheless, the sample could be considered representative of the GDPs who were randomly selected for inclusion in this study, given that there were no differences between respondents and non-respondents regarding sex, age or place of work. The GDPs made their decisions about paper cases instead of actual patients. Although the use of paper cases has been criticised,[28] the method is practical and has been validated.[29,30] The GDPs were asked to make their risk assessments using the VAS, which often serves as a measure of pain and quality of life.[31] However the VAS is also considered reliable in other areas, such as measuring assessments by GDPs and oral surgeons concerning the strength of the indication to remove third molars prophylactically.[32]

Our study was limited to GDPs' assessment of the risk of complications if antibiotics are not administered. We did not study their assessments of the risk of adverse events from antibiotics. Since potential adverse events such as skin rashes and diarrhoea are not serious and anaphylaxis is a very rare consequence, GDPs might believe that they have more control over adverse events and would judge these risks as small.

The interpretation of the results could have a potential problem. We do not know whether the GDPs really assessed the risks as high, or if they made high risk assessments because they had already decided that they would give antibiotics, and therefore made high risk assessments to justify for their decision.

Conclusions

The GDPs' risk assessments were generally higher for patients with medical conditions that are included in recommendations than for those with conditions that are not. Risk assessments were also higher for tooth removal than scaling or root canal treatment. The GDPs administered antibiotics in a manner that was consistent with their risk assessments. In that sense the GDPs were rational. However, they were uninformed since their risk judgments were overestimated and inaccurate in terms of actual risks. Inaccurate judgments of risk should not be expected to disappear in the presence of new information. To achieve change, clinicians must be motivated to improve their behaviour and an evidence-based implementation strategy is required.

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Disclosures

This manuscript has been read and approved by all authors. This paper is unique and is not under consideration by any other publication and has not been published elsewhere. The authors and peer reviewers of this paper report no conflicts of interest. The authors confirm that they have permission to reproduce any copyrighted material.

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