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Healthcare professionals' attitudes to penicillin allergy labels

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Abstract

INTRODUCTION. About 10% of hospital inpatients are labelled with penicillin allergy in their electronic medical record (EMR). However, allergy is confirmed in less than 10% of these records. Consequently, 90% of patients are treated with broad-spectrum antibiotics, contributing to antimicrobial resistance. We aimed to explore experiences and practices of healthcare professionals that may explain incorrect labelling of penicillin allergy in Denmark and elucidate any consequences hereof.

METHODS. An electronic survey was distributed to physicians and nurses in six hospital units in Copenhagen and via social media. The survey was active from 19 March to 1 May 2020. Data were assessed using descriptive statistics and by thematic analysis.

RESULTS. The response rate was 44.6%. The survey had 369 participants; 152 physicians and 217 nurses. Half of the physicians and one in every five nurses had experienced problems treating patients with a penicillin allergy label. Physicians reported limited trust in allergy labels, and labelling practices varied. The risk that patients may be truly allergic was the main reason for not removing labels (72%), and a precautionary principle was identified related to penicillin allergy labelling.

CONCLUSIONS. The penicillin allergy label is an independent factor of medication errors. Solutions to enhance patient safety may include education of physicians in allergy labelling, decision support, standardisation of the allergy registration in the various EMR systems used, and ideally also a national drug allergy register, which is accessible from all sectors.

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Approximately 10% of hospitalised patients in Denmark have a penicillin allergy label in their Electronic Medical Record (EMR). However, studies have shown that only around 10% of patients referred for allergy investigation are truly allergic [1, 2].

Antibiotics, and penicillins in particular, are the drugs most associated with allergies. A Danish study of patients investigated for drug allergy showed that the suspected cause was antibiotics in 93% of cases, and 90% of those were penicillins [2]. Allergy could be confirmed in only 11% of cases. Immediate allergic reactions, including anaphylaxis, are the most feared reactions. However, studies have shown that anaphylaxis is a relatively rare consequence of penicillin allergy [1, 3], and a Danish study reported that only 3.2% of referred patients had anaphylaxis during the primary reaction [4].

Patients and healthcare professionals (HCPs) may confuse non-allergic side effects - such as nausea and abdominal pain - with allergy, leading to incorrect labelling of penicillin allergy [5]. Furthermore, information regarding allergy status is primarily based on self-reported allergy, and many patients believe that they are allergic to penicillin or have been told that they are since childhood [5].

Incorrect labelling of penicillin allergy leads to increased use of more broad-spectrum antibiotics [1, 3]. Unnecessary use of broad-spectrum antibiotics is related to the development of antimicrobial resistance, which is an increasing global health problem [6]. Other consequences include an increased risk of multi-resistant bacterial infections, more side effects, more expensive treatments and prolonged hospital admissions [1, 3].

In Denmark, and globally, a focus has been placed on allergy testing and reevaluating and removing incorrect penicillin allergy labels [2, 7-9]. Interestingly, very little attention has been devoted to correctly documenting allergies or to ensuring information exchange between healthcare sectors. In Denmark, the documentation of drug allergy in the many different EMR systems used in hospitals and in the primary sector is not standardised and varies between the five Danish health regions. Furthermore, no automatic exchange of allergy label data exists between primary care and the hospital sector.

This survey aimed to 1) explore the experiences and practices of HCPs in the Capital Region of Denmark that might cause incorrect labelling of penicillin allergy and 2) to explore any related consequences and solutions.

METHODS

An electronic survey was conducted among physicians and nurses in Denmark in selected hospital departments with a high patient turnover and frequent use of antibiotics.

The anonymous survey (SurveyXact) (see Supplementary material, https://content.ugeskriftet.dk/sites/default/files/2023-07/a03230180-supplementary.pdf) was distributed by e-mail in six units at three hospitals in Copenhagen through a contact person in each unit (physician or nurse in a leading position). The survey was also available via social media (Facebook), in relevant closed HCP groups, and was also shared via the authors' LinkedIn accounts. The survey was accessible from 19 March to 1 May 2020.

The survey was developed by the two first authors based on a literature review and input from two allergologists [8, 10-12].Furthermore, the survey was tested by four physicians and four nurses before being distributed. It consisted of 16-32 questions, most of which were directed towards physicians. The survey included two free-text questions.

The survey addressed the following subjects: demographics, experience and knowledge related to the management of patients with a confirmed/unconfirmed penicillin allergy label, experiences with allergic reactions to penicillins, perceived barriers to removing labels and level of trust in the allergy labels of the EMR, and experiences of having prescribed/administered penicillin erroneously to patients with a penicillin allergy label.

Descriptive statistics were calculated using SurveyXact and IBM SPSS Statistics (ver. 26). Results were presented as numbers with percentage distributions. Selected data were expressed in graphs, using GraphPad Prism (ver. 9.5). Free-text comments were assessed and analysed using thematic analysis (see Supplementary material) [13].

Approvals from the National Ethics Committee and from the Danish Data Protection Agency were not required under Danish law and therefore not obtained.

Trial registration: not relevant.

RESULTS

A total of 369 HCPs, 152 (41%) physicians and 217 (59%) nurses completed the survey. All nurses and 123 physicians worked in hospitals, and 29/152 (19%) physicians were general practitioners (GPs). An overall response rate (44.6% (152/341) could be calculated for three departments. About 29% participants were recruited via social media. A total of 191 free-text comments from physicians were assessed as were 106 comments from nurses. Demographics of all respondents are presented in **Table 1**.

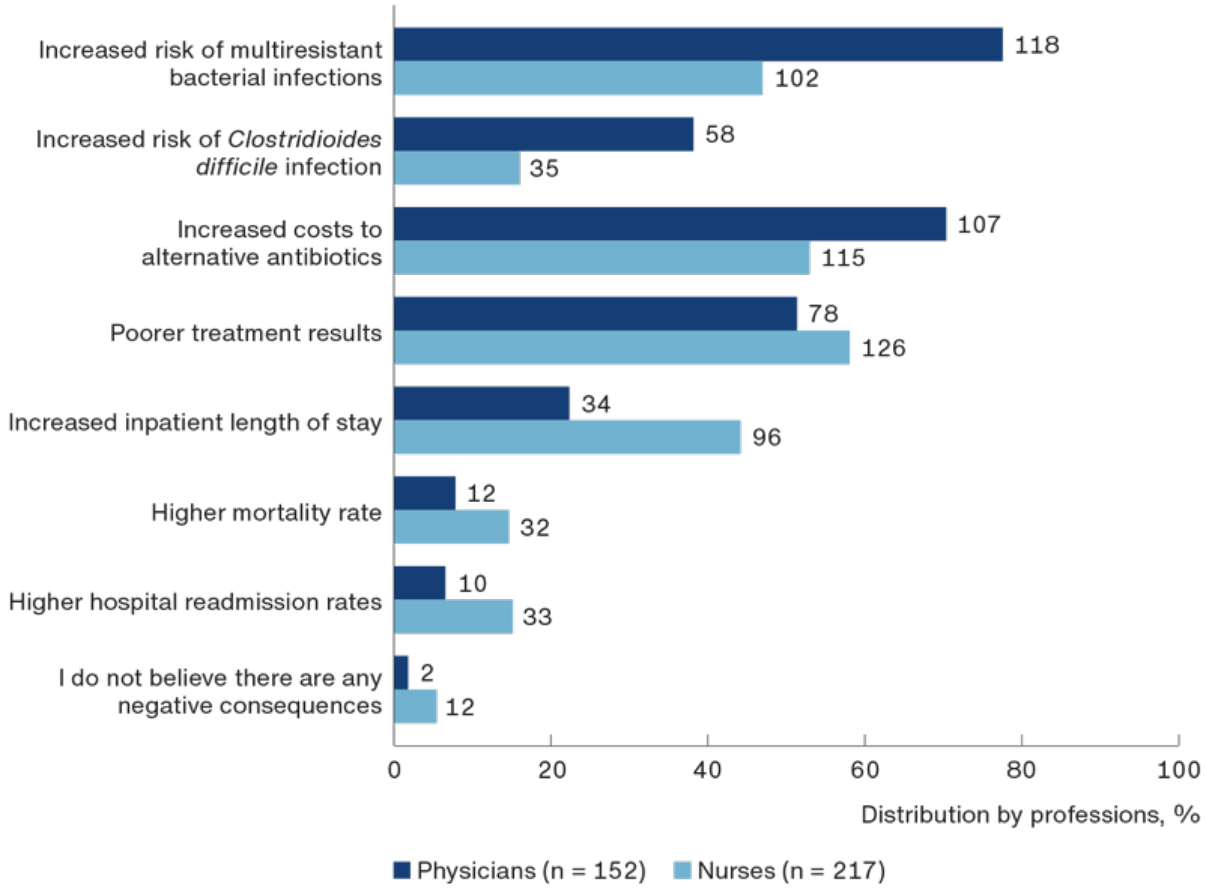
TABLE 1 Demographics of all respondents (N_{tot} = 369).

	Physicians, n (%) (N_{phy} = 152 (41.2%))	Nurses, n (%) (N_{nur} = 217 (58.8%))
Speciality		
Anaesthesiology/intensive care	19 (12.5)	54 (24.9)
Surgical specialities	20 (13.2)	39 (18.0)
Haematology	34 (22.4)	53 (24.4)
Dermatology	19 (12.5)	23 (10.6)
Medical specialities[a]	26 (17.1)	31 (14.3)
Other[b]	5 (3.3)	17 (7.8)
General practice	29 (19.1)	0
Place of employment		
Capital Region of Denmark	126 (82.9)	199 (91.7)
Remaining regions	26 (17.1)	18 (8.3)
EMR system		
Sundhedsplatformen[c]	120 (78.9)	200 (92.2)
Other	32 (21.1)	17 (7.8)
Time since clinical education		
0-5 yrs	28 (18.4)	57 (26.3)
6-10 yrs	20 (13.2)	35 (16.1)
> 10 yrs	104 (68.4)	125 (57.6)

EMR = Electronic Medical Record.
a) Including medical specialities like oncology, endocrinology and cardiology.
b) Psychiatry, paediatrics, emergency department.
c) Developed by Epic.

Most HCPs were aware of the negative consequences for patients and society of having an unconfirmed penicillin allergy label. The most reported consequences were increased risk of multi-resistant bacterial infections, increased costs and poorer treatment results (**Figure 1**).

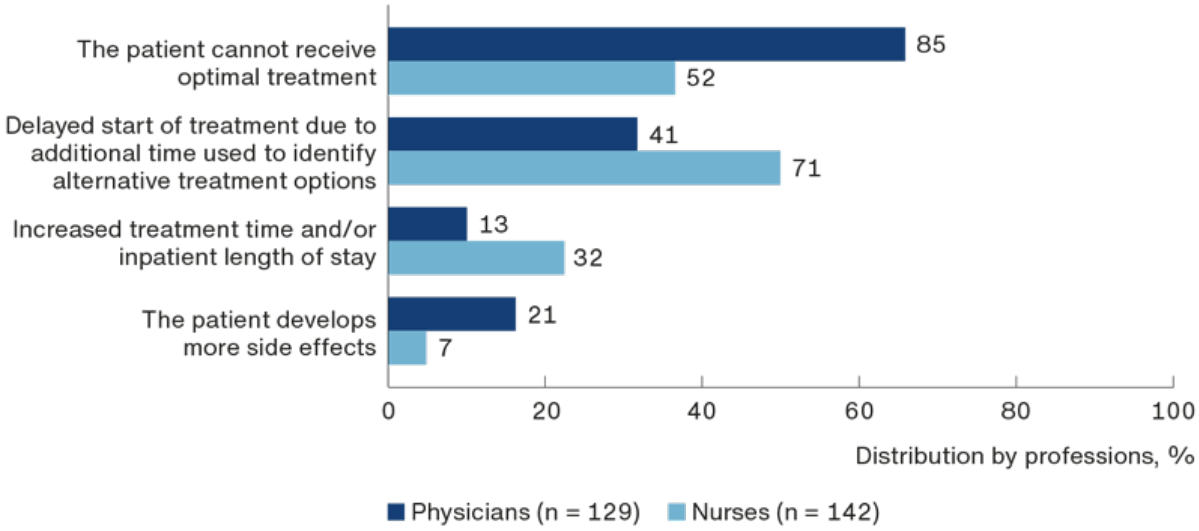
FIGURE 1 "What do you believe to be possible consequences for the patient and society of having an unconfirmed penicillin allergy label registered in the electronic medical record?"



In total, 49% of physicians and 20% of nurses reported having experienced problems to a high or to some degree in clinical practice in relation to patients labelled with penicillin allergy.

Figure 2 presents the answers of participants who reported experiencing problems.

FIGURE 2 Which problems do you experience in the treatment of patients labelled with penicillin allergy?



A total of 93% of all physicians reported that they trusted the penicillin allergy labels in the EMR only to some or a lesser degree.

Based on free text comments regarding reasons for not trusting penicillin allergy labels, four themes were identified:

Insufficient understanding of when and why an allergy label should be registered

Poor documentation of the patient's medical history

Lack of re-evaluation of allergy labels

Lack of an allergological evaluation

The most dominant theme was an insufficient understanding of when and why an allergy label should be registered. Physicians reported inconsistency in the criteria used for registering a penicillin allergy label. The majority believed that only allergic reactions should be registered, whereas others believed that intolerance should be included. Whereas 63/110 (72%) physicians had removed a penicillin allergy label because the patient reported only gastrointestinal discomfort, 63% of all physicians had abstained from removing a penicillin allergy label, which they perceived to be erroneous. The most frequent reason not to de-label was concern that the patient might be allergic (69/96; 72%) (**Table 2**).

TABLE 2 Answers to the question: "Please state why you did not remove the penicillin allergy label?"

	Physicians, n (%) (N = 96)
Related to the physician	
"There might still be a risk of the patient having a true allergy, and I therefore did not wish to change the allergy status of the patient"	69 (71.9)
"I do not believe I have sufficient knowledge about allergy to remove the penicillin allergy label of the patient"	11 (11.5)[a]
Related to the patient	
"The patient was insecure about having the allergy status changed despite my explanation about not being truly allergic"	21 (21.9)
"There were language/communicative/cognitive issues with the patient"	17 (17.7)
Related to the organization	
"I did not have time/I forgot"	16 (16.7)
"It is too difficult/confusing to change allergy status in the EMR"	13 (13.5)[a]

EMR = Electronic Medical Record.
a) Only physicians working in hospitals and all users of Sundhedsplatformen, developed by Epic.

From free-text comments, a "precautionary principle" was identified as being related to HCPs' experiences with registration of penicillin allergy labels in the EMR. HCPs stated that labels are often based on uncertain medical information and have been registered since childhood. It was also suggested that a common practice among physicians is to register a penicillin allergy "to be on the safe side".

Patients with penicillin allergy labels were found to be prone to medication errors. Among the physicians who had prescribed penicillin to a patient despite a penicillin allergy label, 24% (19/79) reported to have done so in error. Furthermore, the two most frequently provided reasons why physicians had removed a penicillin allergy label from the EMR were: "The patient has been administered penicillin by mistake and tolerated the drug" (70/110; 64%) and "Certain documentation that the patient has tolerated the same penicillin drug" (73/110; 66%).

When asked "Is there an automatic exchange of data on allergy status between primary care and hospitals?", 63/123 (51%) physicians in hospitals, 5/29 (17%) GPs and 169/217 (78%) nurses answered that they did not know whether automatic data exchange occurs or not.

DISCUSSION

Only a few studies have investigated HCPs' experiences and practices regarding patients labelled with penicillin allergy [11, 14, 15]. The subject has not previously been addressed in a Danish context.

Generally, an awareness exists of the consequences of penicillin allergy labels and, in our study, 78% of physicians and 47% of nurses reported that an unconfirmed penicillin allergy increases the risk of multi-resistant bacterial infections. A UK study found similar results [11].

Most physicians (72%) in our study responded that they abstained from de-labelling due to the risk that the patient was truly allergic. Wanat et al. reported similar findings [7]. Our quantitative findings regarding de-

labelling along with the many free-text comments indicate that a precautionary principle may be adopted. If physicians fail to recognise a true allergy, the consequences for the patient may be severe. Legally, this may potentially cause individual criticism or trigger a lawsuit. This may enhance precautions causing labels not to be removed, or labels may be registered in order to be better safe than sorry. Fear of litigation is one of the drivers behind the term “overdiagnosis” [16]. Other factors related to the physician are professional insecurity and lack of knowledge. Also, the institutional context behind the healthcare system, the working conditions and the specifications of the EMR system may promote a precautionary principle and enhance overdiagnosis [10, 11].To take an example, overdiagnosis may potentially be enhanced by the lack of a clear distinction between allergy and intolerance in the EMR used by most respondents. Only relatively few physicians in our study reported lack of time/forgetfulness (17%) or the EMR specifications (14%) as reasons for not de-labelling. Only 12% of physicians reported insufficient knowledge about penicillin allergy, which is supported by one UK study [11].

Our results showed that patients with a penicillin allergy label are at risk of being prescribed and administered penicillin. It also clearly showed that most physicians had limited trust in penicillin allergy labels and that they reported inconsistencies in the understanding of when a patient should be labelled “penicillin allergic”. This was also described in other studies [7, 10, 12]. A total of 52% of physicians had prescribed penicillin to a patient with a penicillin allergy label in the EMR and one in four of those had prescribed penicillin in error. The lack of automatic data exchange between the EMR systems in hospitals and primary care in Denmark may contribute to medication errors and might add to physicians’ impaired trust in penicillin allergy labels. In our study, especially HCPs in hospitals were unaware of the lack of automatic data exchange. A recent Danish study showed that 26% of patients with penicillin allergy confirmed by allergy investigation in a hospital allergy clinic did not have a penicillin allergy label in the EMR in primary care, which compromises patient safety [17].

Whilst problems with antimicrobial resistance in Denmark do not yet pose a significant health threat, it is important to maintain this status [18]. Physicians in our survey were aware of this, and 66% reported that unconfirmed penicillin allergy labels in the EMR prevent optimal patient treatment, emphasising the need to address unconfirmed labels.

A need exists for systematic guidance and education on penicillin allergy labelling and de-labelling beyond allergy clinics [15]. Information about which symptoms should be registered as allergy and information on how to avoid registering intolerance or non-allergic side-effects should include assessing the risk of the patient having penicillin allergy from the history of the reaction. A risk stratification tool was developed in the Danish national guidelines for investigation of allergy towards antibiotics [19]. This tool should be used by physicians in hospitals and general practice to risk stratify all penicillin allergy labels and identify which patients may be de-labelled by the physician and which should be referred to an allergy clinic. In addition, attention should be devoted to ensuring that only correct labels are registered because once an allergy is registered, it remains listed in the patient's EMR for many years [17].

Efforts to increase awareness and implement risk stratification in all sectors of the health service will minimise incorrect labelling and ensure de-labelling and investigation of relevant patients leading to improved patient care while helping to prevent antimicrobial resistance. Studies on risk stratification and de-labelling are currently being conducted in many countries accross the world, but so far no consensus exists as to the ideal strategy [9].

EMR decision support on allergy registration and standardisation of the allergy field in the various EMR systems needs to be addressed as this would enhance the knowledge of and underpin decision-making regarding penicillin allergy status. Furthermore, the allergy status in the various EMR systems needs to be automatically exchanged across primary and secondary healthcare to avoid medication errors [20]. Implementation of a

national drug allergy register, along with clear guidance on how to use and update any register information, would greatly improve patient management and patient safety by reducing the risk of potentially fatal medication errors.

This study has strengths and limitations. Respondents were HCPs from a variety of specialties, primarily from the Capital Region of Denmark. Selection bias is likely as those with experience and those who take an interest in the subject may have a higher propensity to respond, especially via social media. Most respondents had more than ten years of experience, which may also have affected our findings. The response rate was 44.6%, which is acceptable keeping in mind the findings of a similar survey study [14]. Including both physicians and nurses in this exploratory study was considered valuable since they work closely together in the treatment of patients labelled with penicillin allergy. It would have been desirable to include more GPs, but this was not possible due to COVID-19 restrictions. A very large amount of free-text comments was received, indicating that the use of penicillin allergy labels in clinical practice is an area deserving a high priority.

CONCLUSIONS

This study provided insight into how HCPs' experiences and practices may contribute to incorrect labelling of penicillin allergy and any related consequences and solutions.

Organisational efforts to limit incorrect labelling of penicillin allergy in Danish patients should be implemented and directed primarily towards the initial evaluation of a possible penicillin allergy. Physicians' clinical practice work may be underpinned by implementation of the already available risk stratification tool along with clear guidance on how to register penicillin allergy in the various EMR systems. Furthermore, EMR decision support on allergy may assist physicians in clinical practice. These efforts would be greatly enhanced by implementing a national drug allergy register, which – if used correctly – would potentially improve patient management and strengthen patient safety.

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REFERENCES

1. Shenoy ES, Macy E, Rowe T, Blumenthal KG. Evaluation and management of penicillin allergy: a review. JAMA. 2019;321(2):188-99.
2. Fransson S, Mosbech H, Kappel M et al. The importance of prolonged provocation in drug allergy - results from a Danish allergy clinic. J Allergy Clin Immunol Pract. 2017;5(5):1394-401.
3. Castells M, Khan DA, Phillips EJ. Penicillin Allergy. N Engl J Med. 2019;381(24):2338-51.
4. Hjortlund J, Mortz CG, Skov PS, Bindslev-Jensen C. Diagnosis of penicillin allergy revisited: The value of case history, skin testing, specific IgE and prolonged challenge. Allergy. 2013;68(8):1057-64.
5. Andersen SE, Garvey LH. Lægemiddelallergi eller bivirkning? Månedsskr Alm Prak. 2016;(1):7-14. https://maanedsskriftet.dk/shop/manedsskriftet/1323-11216.html.

6. Antimicrobial Resistance Collaborators. Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis. Lancet. 2022;399(10325):629-55.
7. Wanat M, Anthierens S, Butler CC et al. Management of penicillin allergy in primary care: a qualitative study with patients and primary care physicians. BMC Fam Pract. 2021;22(1):112.
8. Powell N, Wilcock M, Roberts N et al. Focus group study exploring the issues and the solutions to incorrect penicillin allergy-labelled patients: an antibiotic stewardship patient safety initiative. Eur J Hosp Pharm. 2021;28(2):71-5.
9. Fransson S, Boel JB, Mosbech HF et al. Safe de-labeling of patients at low risk of penicillin allergy in Denmark. Int Arch Allergy Immunol. 2022;183(6):640-50.
10. Wilcock M, Harding G, Moore L et al. What do hospital staff in the UK think are the causes of penicillin medication errors? Int J Clin Pharm. 2013;35(1):72-8.
11. Wilcock M, Powell N, Sandoe J. A UK hospital survey to explore healthcare professional views and attitudes to patients incorrectly labelled as penicillin allergic: an antibiotic stewardship patient safety project. Eur J Hosp Pharm. 2019;26(6):329-33.
12. Wanat M, Anthierens S, Butler CC et al. Patient and primary care physician perceptions of penicillin allergy testing and subsequent use of penicillin-containing antibiotics: a qualitative study. J Allergy Clin Immunol Pract. 2019;7(6):1888-1893.e1.
13. Malterud K. Systematic text condensation: a strategy for qualitative analysis. Scand J Public Health. 2012;40(8):795-805. doi: 10.1177/1403494812465030.
14. Staicu ML, Soni D, Conn KM, Ramsey A. A survey of inpatient practitioner knowledge of penicillin allergy at 2 community teaching hospitals. Ann Allergy Asthma Immunol. 2017;119(1):42-7.
15. Collins K, Rueter K, Lucas M et al. Penicillin allergy SHACK: survey of hospital and community knowledge. J Paediatr Child Health. 2022;58(8):1414-9.
16. Pathirana T, Clark J, Moynihan R. Mapping the drivers of overdiagnosis to potential solutions. BMJ. 2017;358:j3879.
17. Fransson S, Boel JB, Holm A et al. Inconsistencies of penicillin allergy labels in hospitals and primary care after allergy investigation. Clin Exp Allergy. (online 29 May 2023).
18. Attauabi M, Høg BB, Müller-Pebody B, eds. Summary Danmap 2020. DTU, 2021. https://www.danmap.org/reports/2020.
19. Tannert LK, Mosbech H, Hjortlund J et al. Work-up of penicillin allergy. Ugeskr Læger. 2020;182:V02200116.
20. Sijbom M, Braun KK, Büchner FL et al. Cues to improve antibiotic-allergy registration: a mixed-method study. PLoS One. 2022;17(4):e0266473.