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A Survey of Healthcare Professionals' Attitude and Awareness towards Quick Response Codes and Review of its Possible Applications in Medical Education and Pharmaceutical Industry

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ABSTRACT

Medicine is rapidly adopting newer technologies such as Quick Response (QR) codes to effectively and efficiently manage, share and store information. QR codes can have a wide variety of applications in the healthcare, medical education and pharmaceutical industry. This article aims to explore the applications of Quick Response code in Medicine and other affiliated sectors. Through this survey we have tried to score the attitude and awareness of healthcare professionals towards the viability of QR codes. The study sample was of n = 142 respondents. Majority of respondents were aware about the utility of QR codes in day-to-day aspects and academics with Online transactions being the predominant usage. 84.5% respondents were aware of the technology involved in QR codes and 83.1% respondents had used the QR code in different scenarios. Despite the awareness only 21.1% respondents knew how to create a QR code. Overwhelming majority of 80.3% respondents replied that they would prefer access to educational material and recording of attendance through QR codes. According to the findings, awareness of technology and use of QR codes is not a significant factor in QR code acceptance in accessing study material and attendance. But we have a significant p-value (p value = 0.017) when acceptance of QR codes in medical education was significant among healthcare professionals who were exposed to QR codes in the Department of Pharmacology. Our findings further suggest that most healthcare professionals have convenient access to the technology essential to generate QR codes, and yet, about 21.1% of healthcare professionals are unaware of the technique for QR code generation. Based on this finding, we conclude that knowledge of QR codes and use of QR codes outside of the medical setup doesn't affect the acceptability of QR codes in healthcare professionals, but when they're exposed to QR codes in the medical setup, there is a significant correlation in acceptance of QR codes for study materials and attendance. From our results, we can conclude that most healthcare workers and medical students approve of more integration of QR codes in medical workflow and agree with the convenience and ease of use and easier access to information.

Keywords: Medical education; Behaviour modification; Pharmaceutical Industry; Healthcare; Quick Response code

1 INTRODUCTION

To understand the applications of QR codes, we first need to understand the technology and define a QR code. A QR code is a matrix bar code (Figure 1) that stores data, generally URLs, text, v-Cards, or photo to guide consumers to online products or websites efficiently. The first QR code was developed in 1994 the Japanese automotive company Denso Wave. Still was not until recently that the ordinary public accessed it with broader access to smartphones.

The Quick Response system gained wide acceptance outside the automotive industry because of fast readability, reliability, convenience, and huge storage capacity than standard UPC barcodes. Applications range from tracking parts to product or identification of item, document

Fig. 1: The English Wikipedia Mobile home page's QR code (Source: Wikipedia.org)

Fig. 2: Example of a Quick Response (QR) Codes in Poster Presentation (Source: Google Images)

15 management, time tracking, and general mercantile.

16 As the COVID-19 became pandemic, use of QR codes
17 got momentum as a "touchless" system to present infor-
18 mation, display menus, or offer updated and streamlined
19 consumer information, especially in the hospitality industry.
20 Restaurants replaced paper or laminated plastic menus by
21 QR code decals on the table, which provided digital menu
22 card. This avoided the necessity of disposing single-use paper
23 menus or additional cleaning and sanitizing procedures for
24 permanent menus after each use. Digital media have also
25 started using codes on news telecast so that viewers can
26 access stories or news about the pandemic, including testing
27 and immunization schedule.

28 In several Australian states, patrons must access QR codes
29 at shops, clubs, supermarkets, and other service and retail
30 outlets on entry to assist in contact tracing. Singapore,
31 Taiwan, the United Kingdom, and New Zealand use similar
32 mechanisms.

33 QR codes are also present on COVID-19 vaccination
34 certificates in places such as India, Canada, and the EU
35 (EU Digital COVID certificate), where they can be accessed
36 to scrutinise and cross-verify the information on the
37 certificate.[1]

38 There are numerous applications for the integration of QR
39 codes in Medicine, some of which are listed below:

QR codes in Medical Education

41 Conference poster presentations can benefit greatly from
42 the use of QR codes. A QR code, rather than simply
43 putting images to a poster, allows conference participants
44 to incorporate videos that presenters have connected to
45 their signs. This technology expands information exchange
46 in static 2-dimensional posters. It includes multimedia
47 presentations that enhance the poster's educational value by
48 presenting slideshows (Figure 2) or films of uncommon case
49 reports, surgical techniques, or other video-centric material.
50 QR codes also give useful resources, such as the presenter's

51 vCard, contact information, references, extra material, or
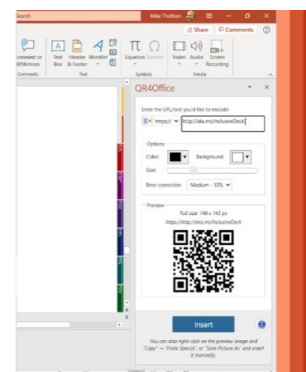52 feedback questionnaires.[2]

Fig. 3: Example of integration of the Quick Response (QR) Codes in PowerPoint Presentations (Source: Google Images)

53 Beyond posters, QR codes can enhance the educational
54 content of lecture presentations (Figure 3) by:

55 (a) quickly guiding learners toward resources to prepare
56 for lectures, and

57 (b) extra stress on information by linking relevant articles,
58 videos, or other classes.

59 QR codes also can be integrated into print or digital
60 publications. When added to journal articles or textbook
61 chapters, they can link to less effectively modelled resources
62 in fixed 2-dimensional figures. Rather than using photos or
63 graphs, QR readers can show videos or dynamic graphs and
64 models that can be updated and enhanced over time. The
65 QR codes allow print and online resources to be converted
66 interchangeably by embedding videos not earlier possible on
67 printed resources.

68 Because QR codes are shareable, they are apt for clinical
69 simulations, which educators are using to creatively engage
70 learners to apply knowledge and act in real-time simulated
71 clinical scenarios.[3–5]

72 At academic teaching hospitals, a number of small
73 studies have discovered a correlation between improved

applicability and quicker feedback when QR readers are utilised for trainee assessment.

QR codes in Pharmaceutical Industry

There are numerous challenges that a pharmaceutical company and its consumers face regularly. One of those challenges is a counterfeit product. Using QR can assist the development get an additional level of legitimacy. Moreover, QR codes can ensure more accessible access to product manuals and related info graphics.

QR codes at the Department of Pharmacology, Rajasthan University of Health Sciences

We at RUHS-CMS Jaipur have started an initiative of digitally cataloguing our Experimental Lab Equipment, Research lab Equipment and Pharmacology museum exhibits (Figure 4).

Moreover, we have made those digital catalogues accessible to our students through QR codes.

Fig. 4: QR codes at the Department of Pharmacology, RUHS-CMS, Jaipur, India

Fig. 5: QR codes at the Department of Pharmacology at RUHS-CMS for GMHAT.

We have also provided our students with QR codes based access to online mental health assessment tools (GMHAT) (Figure 5) to keep track of their mental health.

At the Department of Pharmacology, RUHS-CMS, we are also planning for an attendance method that utilises QR codes that students can scan with their smart phones at the entrance to the lecture hall, and their Attendance will automatically get recorded in an Excel sheet.

INDIAN SCENARIO

The Department of Pharmaceuticals, Government of India mandated QR Codes on all pharmaceutical packages. The primary goal is to pass on the benefits of fair pricing to customers. Furthermore, to keep customers informed of any price decreases or increases. [6]

The QR Code scanner is linked to software that has price information for all brands. This is overseen by the National Pharmaceutical Pricing Authority (NPPA). Any pricing change is automatically updated in the software. Customers receive real-time information on the pricing of the Medicine when they scan it. As a result, they may pay properly.

SCENARIO ABROAD

Many other countries have recognised the usefulness of QR Codes and have provided regulatory guidelines to accelerate the adoption of this technology. The European Medical Agency (EMA), for example, has recognised QR Codes' enormous potential in the pharmaceutical industry. As a result, it has created guidelines and restrictions for all brands and firms who want to incorporate QR codes into their prescription packaging.

HOW TO CREATE A QR CODE

Five-step guide to how to make a QR code for a link includes:-

1. Find a good quality QR code generator that can offer both free and paid QR codes;
2. Open the menu and enter the URL or your username on the given field;
3. Select "Generate Code" and modify your QR code by applying multiple patterns and eyes, adding a logo, and setting colours;
4. Download your QR code and make sure that it works; and
5. Distribute the downloaded QR code to your target audience

MATERIALS AND METHOD

Researchers, including healthcare professionals, postgraduate medical students, and a medical professor, conducted a pilot cross-sectional study using a self-constructed e-questionnaire (Table 1). The questionnaire was created

with Google Forms containing 13 questions about QR code utility, generation technique, and prevalent usage and also a consent statement (Table 2) from participants. Healthcare professionals from Rajasthan, including medical and paramedical students, were eligible to participate. Respondents who refused to fill out the survey, provided incomplete responses, or opted out of the survey process were excluded from the results analysis.

Participants were also encouraged to share the survey with their contacts in order to boost participation and response rates. The study protocol was approved by the Institutional Ethical Review Board (Ref No.: ECR/434/Inst./RJ/2013/RR-19, dated:7th July 2022).

Table 1: Google form Questionnaire

S.No.	Questions Asked
1	Please specify your gender
2	What is your age?
3	What is your role as a Healthcare professional?
4	Are you aware about the technology involved and the uses of QR codes?
5	How much do you know about what a QR code is?
6	Have you used QR Codes before?
7	Where or for what do you use the QR codes the most?(List as many uses as possible)
8	Do you know about how to create a QR code?
9	Are QR codes easy to use?
10	Do you find QR codes useful?
11	Have you accessed the QR codes displayed in the Department of Pharmacology?
12	Do you find the QR code displayed in the Department of Pharmacology useful?
13	Would you prefer educational material access and student attendance automated through QR codes?

Table 2: Consent Statement

Consent Statement	Response
All information provided by you (survey participants) will be kept strictly confidential, and submitted data will not be shared with anyone. The information provided will be published in the form of a research study, poster presentations, academic articles, and so on. Please confirm that you understand, appreciate, and can reason through all of the information provided to you regarding the questionnaires and the objectives of this study, and that you consent to the use of the above information for the purpose of the study.	YES/NO

STATISTICAL ANALYSIS

Microsoft Excel's Data Analysis toolpak was used for statistical analysis. Descriptive statistics such as frequencies and percentages for categorical data and mean and standard deviation for numerical data are shown. Regression analysis was used to compare the frequencies of prominent factors (independent variables) with the Dependent variable. P <0.05 was considered statistically significant for all statistical tests, with a 5% margin of error.

RESULTS

The survey sample consisted of 142 respondents, 50.7% of whom were females and 48.6% of whom were males. 96.5% of respondents were between the ages of 15 and 25, while 3.5% were between the ages of 26 and 45. Figure 6 shows that 76.8% of respondents were students, 18.3% were doctors, and the remaining 4.9% worked in paramedical services. The majority of respondents were aware of the utility of QR codes in everyday life and academics, with online transactions being the most common application. 84.5% of respondents were aware of the technology behind QR codes, and 83.1% had used the QR code in various scenarios (Figure 7). Google form responses were fed into Microsoft excel sheets, and responses were quantified and given a numerical value. For example, reactions ranging from strongly agree to disagree strongly (Figure 8) were quantified on a numerical scale of 1 to 5. Despite their awareness, only 21.1% of those polled knew how to make a QR code (Figure 9).
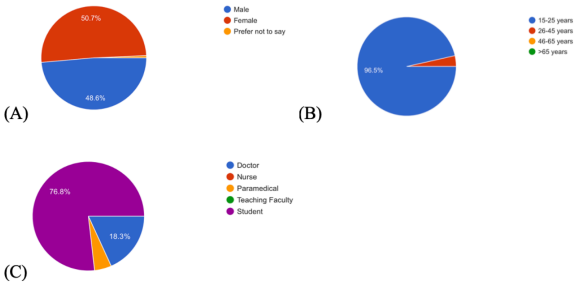

Fig. 6: Demographic data from the QR code survey Google Form. (A)= Gender, (B)= Age Range, (C)= Role in Healthcare

The three hypotheses' P-values were calculated using Microsoft Excel's Data Analysis toolpak.

Hypothesis 1(H1)

N_0 = Knowledge of QR codes is not a factor for wanting to see QR codes implemented in Material access and Attendance

N_1 = Knowledge of QR codes is not a factor for wanting to see QR codes implemented in Material access and Attendance. Who are aware of QR code technology and wants to see QR codes implemented in Material access and Attendance?
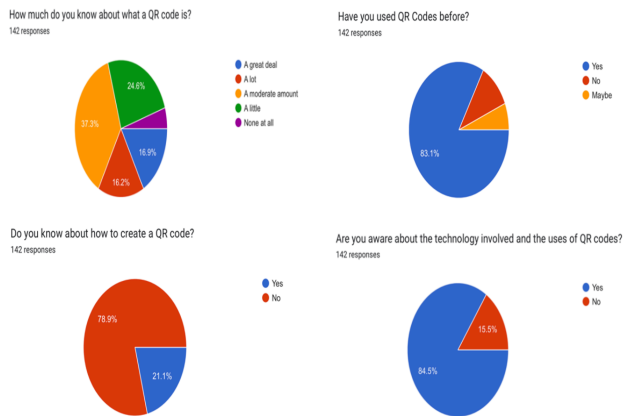
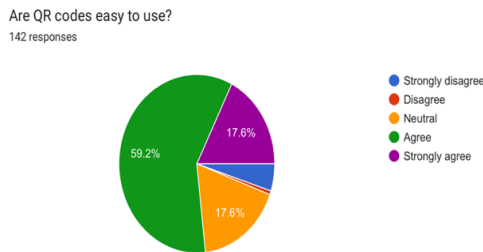**Fig. 7:** Pie chart for QR code awareness from the QR code survey Google Form

Fig. 8: Pie Chart for healthcare professionals' perception about the ease of use of the QR codes
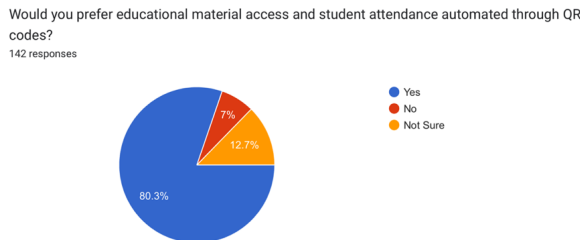

Fig. 9: Pie Chart for healthcare professionals' acceptance for study material access and attendance through automated approaches using the QR code

Hypothesis 2(H2)

N_0 = Participants who have accessed QR codes displayed in the Department of Pharmacology may not prefer to access educational material and student attendance automated through QR codes

N_1 = Participants who have accessed QR codes displayed in the Department of Pharmacology would prefer to access educational material and student attendance automated through QR codes.

Hypothesis 3(H3)

N_0 = Having used QR codes is not a significant factor in the preference of educational material access and student attendance being automated through QR codes

N_1 = Having used QR codes is a significant factor in the preference of educational material access and student attendance being automated through QR codes.

Respective p-values for all the tested hypotheses are presented in Table 3.

Table 3: p-values for the tested hypothesis

Hypothesis	P – Value
Hypothesis 1(H1)	0.1684
Hypothesis 2(H2)	0.0176
Hypothesis 3(H3)	0.3201

DISCUSSION

Results indicate that awareness of technology and the use of QR codes is not a significant factor in the acceptance of QR code usage in accessing study material and Attendance. Nevertheless, we have a significant p-value (p-value = 0.017) when acceptance of QR codes in medical education was not substantial in healthcare professionals exposed to QR codes in the Department of Pharmacology. The results indicate that knowledge of QR codes and use of QR codes outside of the medical setting do not affect the acceptability of QR codes by healthcare professionals. Still, when they are exposed to QR codes in the medical setup, there is a significant correlation between acceptance of QR codes for study materials and Attendance.QR codes can be used in a variety of industries, including healthcare, medical education, and pharmaceuticals. Our findings indicate that the majority of Healthcare professionals have easy access to the technology required to generate QR codes. However, approximately 21.1% of healthcare professionals are unaware of the QR code generation technique.

LIMITATIONSOF QR CODES

The main limitation of this technology is the access to smartphones and reliable internet connection.

Although smartphones are available in all price ranges, the smartphone penetration in the population is 30-70%, depending on the region's geography, socioeconomic situation, and internet access.

Another limitation is the lack of knowledge amongst medical professionals, educators, and students about how to use this technology effectively and how to create and integrate QR codes in their activities. With the ease of use, these QR codes also risk phishing cyber-attacks, and scanning a wrong malicious code may infringe upon patron's digital privacy and install harmful apps in the device. Hence proper awareness about how to use these codes

while protecting self from phishing attacks requires adequate knowledge and understanding of this technology.

CONCLUSION

QR codes are trusted tools for increasing access to online resources such as videos, infographics, and instant feedback in presentations, posters, and publications. Furthermore, they may transform information sharing and promote interactivity in teacher-less, flipped, or hybrid classrooms through discussions, workshops, and simulations. Also, QR codes can help pharmaceutical companies safeguard their consumers from counterfeit products and misleading information.

Based on our results of the tested hypothesis in our study, we can conclude that most Healthcare workers and medical students approve of more integration of QR codes in medical workflow and agree with the convenience, ease of use, and easier access to information. This study employed QR codes as an example of a newer tool for improving student interaction in medical education, but many other technological innovations in various educational settings can be examined for acceptance using the same methods.

Availability of Data and Materials

The data supporting the study's conclusions is available upon request from the corresponding author. The data is not publicly available to protect the participants' privacy because it contains identifiable information such as email IDs.

REFERENCES

1. Faggiano A, Carugo S. Can the implementation of electronic surveys with quick response (QR) codes be useful in the COVID-19 era? *Internation Journal of Epidemiology*. 2020;(dyaa170):1–3. Available from: https://doi.org/10.1093/ije/dyaa170.

2. Brodie K, Madden LL, Rosen CA. Applications of Quick Response (QR) Codes in Medical Education. *Journal of Graduate Medical Education*. 2020;12(2):138–140. Available from: https://doi.org/10.4300/JGME-D-19-00516.1.

3. Ramalingam ND, Tran HN, Gangopadhyay A. As Simple as Taking a Picture—How Use of QR Codes Improved Evaluation Response Rates, Documentation, and Timeliness. *Journal of General Internal Medicine*. 2020;35(5):1615–1616. Available from: https://doi.org/10.1007/s11606-020-05674-9.

4. Snyder MJ, Womack JJ, Nguyen D, Bunt CW, Westerfield KL, Bell AE, et al. Testing Quick Response (QR) Codes as an Innovation to Improve Feedback Among Geographically-Separated Clerkship Sites. *Family Medicine*. 2018;50(3):188–194. Available from: https://doi.org/10.22454/fammed.2018.936023.

5. Abdollahi AM, Masento NA, Vepsäläinen H, Mijal M, Gromadzka M, Fogelholm MM. Investigating the Effectiveness of an Educational Escape Game for Increasing Nutrition-Related Knowledge in Young Adolescents: A Pilot Study. *Frontiers in Nutrition*. 2021;8(674404):1–9. Available from: https://doi.org/10.3389/fnut.2021.674404.

6. QR Codes In The Pharmaceutical Industry: Four Amazing Use Cases. 2022. Available from: https://scanova.io/blog/qr-codes-in-pharmaceutical-industry/.