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TABLE OF CONTENTS

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ABSTRACTS OF THE ARTICLES:

RAPID LITERATURE REVIEW

Monitoring Devices for glucose in critical patients during the COVID-19 pandemic:

an update on International Evidence

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Keywords: Glucose Continuous Monitoring (CGM), real-time continuous glucose monitoring (rtCGM), COVID-19; ICU, Monitoring Devices, Dexcom G6, Intensive care units (ICU), critical care

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ABSTRACT

Background: Hyperglycemia is common in Intensive Care Unit (ICU) and was reported with high mortality and adverse patients' outcomes. The infection of COVID-19 is identified as a main source of increase in the incidence of hyperglycemia and associated elevated mortality. In order to reduce the healthcare providers exposure and the personal protective equipment use during the pandemic, the US Food and Drug Administration (FDA) regulated the usage of continuous glucose monitoring (CGM) devices to address these concerns as well as control the glucose level at a desired range. What are the benefits of using CGM applications? The article updates knowledge on this topic.

Methods : We did our search on the following databases: MEDLINE, EMBASE and Cochrane database, articles included were all recent and between January 2020 to July 2022. Our main focus was on articles with evidence concerning the effectiveness and the accuracy of continuous blood glucose monitoring methods in ICU during the COVID-19 pandemic.

Results: A few recent articles were identified and scrutinized. These allow the article to present an overview of the most recent international evidence on the topic, ts benefits and a comparison between methods and devices.

Main Contribution to Evidence-Based Practice: The article puts together the most recent evidence on the demonstrated benefits of continuous glucose monitoring and identifies the few glucose Monitoring Devices about which there is recent published scientific evidence on its application to critical care.

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What do we already know about this topic?

There is available evidence that supports the adoption of monitoring devices for continuous glucose monitoring (CGM) in different settings. In critical care contexts there is a need for an update on recent concrete evidence.

What is the main contribution to Evidence-Based Practice from this article?

It is an update on recent evidence related to CGM and glucose management for critical patients during COVID-19 pandemic and the benefits for maintaining CGM and its impacts on patient data accuracy and patient safety. The authors report on the recent evidence available to support clinical decision and evidence-based practice by health professionals around the World.

What are your research's implications towards theory, practice, or policy?

The article identified the need for further research on the different devices available in the global markets. In addition, the article identifies evidence demonstrating that CGM management can reduce the workload of nurses, the healthcare providers' exposure and the PPE use during a pandemic. Increased nurses' satisfaction levels are associated with its application. The article also identified one monitoring device commonly used, namely Dexcom G6. The device was approved by FDA in 2021 for use in outpatient but is also being used in critical patient care of COVID-19 patients in ICUs.

Authors' Contributions Statement:

Made substantial contributions to conception and design, or acquisition of data Xiujuan Xue, Cuiping Xu Involved in drafting the manuscript or revising it critically for important intellectual content; Yeqing Wang, Jing Wang, Jinyan Zhao,Yalin Tang. Acquisition of data and analysis and interpretation of data: Xueqing Song. Given final approval of the version to be published. Each author should have participated sufficiently in the work to take public responsibility for appropriate portions of the content; Xiujuan Xue, Yeqing Wang, Jing Wang, Jinyan Zhao,Yalin Tang, Xueqing Song, Cuiping Xu. All authors agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Stress-induced hyperglycemia occurs in over 90% of the patients admitted to Intensive Care Unit (ICU), irrespective of a previous diagnosis of diabetes (van Steen et al., 2017). Hyperglycemia was reported with high mortality and adverse patients' outcomes (Sardu et al., 2020; Yao et al., 2020) and these findings have highlighted the importance of glucose control in critical patients.

However, as for the patients with COVID-19, the glucose control would be more complicated. Numerous factors, including stress imposed by COVID-19 infection, critical illness, and frequent glucocorticoid use, patients with COVID-19 and diabetes can develop severe hyperglycemia or diabetic ketoacidosis. Elevated blood glucose in hospitalized patients with COVID-19 has also been associated with increased mortality (Zhu et al., 2020). Although intravenous (IV) insulin infusion is the standard of care for hyperglycemia management in the intensive care unit (ICU), however, this protocol requires frequent blood glucose measurements point-of-care (POC) every one to two hours which can increase the workload of nurses. Besides, the increased frequencies of glucose measurements will present a significant challenge amid the COVID-19 pandemic because of increased personal protective equipment (PPE) use and increased transmission risk to health care providers (HCP)(Sadhu et al., 2020).

To address these concerns, the US Food and Drug Administration (FDA) issued a policy in March 2020 to allow the use of real-time continuous glucose monitoring (rtCGM) systems reduce HCP exposure and the PPE use during the current pandemic. rtCGM devices sample interstitial glucose levels every 5 minutes and the data are automatically transmitted to a handheld receiver outside of the patient's room that displays the current glucose level, glucose trends, and trend arrows, which indicate the direction and velocity of changing glucose (Chow, Kelly, Gupta, & Miller, 2021).

However, despite the advantages, there are specific concerns that several factors may affect CGM performance in the ICU, including changes in tissue perfusion or edema, hydration, acid-base balance, and medication interference and several CGM trials in critically ill patients in the ICU focused on accuracy, reliability and other aspects.

This article is a topic focused rapid review of articles published in the period January 2020–July 2022 regarding CGM in critical patient glucose management during COVID-19. The review examines two questions. First, does the evidence indicate whether CGM used in critical performed comparable or even better results as the traditional method? Second, what CGM devices are recommend to be used?

Methods

We did our search on the following databases: MEDLINE, EMBASE and Cochrane database, from January 2020 to July 2022. Our main observations are effectiveness and the accuracy of continuous blood glucose monitoring method in ICU during the COVID-19 pandemic. These were searched for English-language articles with search terms as described below.

Search strategies: blood glucose[MeSH Terms]) OR (blood sugar)) OR (glycemic)) OR (glycaemia)) OR (Hyperglycemia)) OR (blood glucose)) AND (((((management) OR (control)) OR (intervention)) OR (monitor)) OR (monitoring))) AND ((((intensive care unit[MeSH Terms]) OR (critical care[MeSH Terms])) OR (ICU)) OR (critical illness[MeSH Terms]))) AND (((((COVID 19[MeSH Terms]) OR (SARS-CoV-2 Infection[MeSH Terms])) OR (COVID-19)) OR (SARS-CoV-2)) OR (novel corona virus)) Filters: from 2020 – 2022.

Additional articles were found by manually screening references of relevant articles and reviews on the same topic. Articles that met any of the following criteria to be included: every study with reference to “glucose management in critical care patients during the COVID-19 pandemic, published after January 2020, reported outcomes data on glucose related indicators, identified the monitoring device used.

Results

The first relevant article identified is a case report about continuous glucose monitoring to assess parenteral nutrition（PN）induced hyperglycemia in an adult patient with severe COVID-19(Chow, Kelly, Gupta, et al., 2021). PN-induced hyperglycemia, especially within 24 hours of PN initiation, has been shown to be a predictor of hospital mortality and is associated with increased length of stay. This case demonstrates the potential utility of real-time continuous glucose monitoring （rtCGM）in the critical care setting and highlights its potential to help conserve personal protective equipment and minimize unnecessary staff exposure in the setting of COVID-19. Meanwhile, this article demonstrated that rtCGM correlated well to the gold-standard venous glucose measurements. The lesson learned from this case is the need for earlier initiation of rtCGM, which would have allowed for more rapid titration of insulin infusion when glucose levels were rising subsequent to starting PN. The monitoring device is real-time continuous glucose monitoring (rtCGM) in this article.

The second relevant article was performed by Archana et al(Sadhu et al., 2020). The article was a feasibility pilot study using CGM in critically ill patients with COVID-19 in the intensive care unit (ICU). In this study, CGM devices were placed on 11 patients to evaluate the feasibility of using CGM in critically ill patients with COVID-19 for real-time sensor glucose (SG) trends with intermittent point-of-care blood glucose (POC-BG) testing to guide insulin therapy. The findings of this study support that CGM is feasible in critically ill patients and has acceptable accuracy to identify trends and guide intermittent blood glucose monitoring with insulin therapy. This article indicated that continuous glucose monitoring (CGM) has emerged as an alternative for inpatient point-of-care blood glucose (POC-BG) monitoring. The monitoring device is CGM a or Dexcom G6.

The third article was performed by Citlalli et al in 2021(Perez-Guzman et al., 2021). It is a clinical trial looked into the accuracy Continuous Glucose Monitoring (CGM) in the Operating Room and Cardiac Intensive Care Unit by comparing the real-time CGM with periodic point-of-care (POC) in 15 patients. This trial provides strong evidence for GCM use in ICU, that we can use the technology in the sickest patients, except during surgery, aiming at

achieving better glycemic control while reducing the burden of diabetes care. The monitoring device is Dexcom G6 Continuous Glucose Monitoring (CGM).

The fourth article is a retrospective observational study conducted in 2020. It provides evidence for the safety of IV insulin management using a combined point-of-care blood glucose (POC) plus CGM regimen by reviewing clinical data from 19 patients with COVID-19 in ICU. In this study, the hybrid POC plus CGM model can be safely applied to patients with critical COVID-19 disease, including those requiring mechanical ventilation, vasopressors and renal replacement therapy, and the sensor monitoring accuracy of the GCM is less affected by oxygen saturation, mean arterial pressure and vasopressors. Data showed that the protocol significantly reduced POC testing, patient pain, blood loss and sleep disruption, and cost. The study was limited by an observational design that requires a prospective multicenter study in a more diverse group of critically ill patients to look at its safety. The monitoring device is Dexcom G6 Continuous Glucose Monitoring.

The fifth study was from Georgia M (Davis et al., 2021). The study involved nine patients requiring mechanical ventilation and corticosteroids. A computerized algorithm called Glucommander is applied to adjusts the multiplier according to glucose trends, insulin sensitivity and response to therapy. The results show that patients with diabetes and active or suspected COVID-19 started the hybrid CGM/POC Glucommander protocol with improvement in glycemic control within 12h and consistent validation for most sensor values. Thus, a protocol involving stakeholders to implement a hybrid approach with hourly HER documentation guiding computerized CII is feasible and can reduce POC glucose testing without compromising glycemic control. Real-time CGM sensors are not yet a replacement for POC testing due to possible disturbances during critical care, resulting in discrepancies between POC and sensor glucoses values, but the technology has advanced significantly and could provide meaningful improvement in patient care. The monitoring device is Real-time CGM sensors and POC testing.

The sixth article aimed to investigate the accuracy of CGM in hospitalized patients on the general care floor and in the intensive care unit. It was conducted by Rebecca et al in 2021(Longo, Elias, Khan, & Seley, 2021). Experimental results demonstrate that, with appropriate protocols and safety measures in place, the use of CGM in hospitalized patients is a reasonable alternative to standard care to achieve the goal of reducing exposure to healthcare professionals. However, further research is needed to verify the safety, accuracy and efficacy of the technology. The monitoring device is Continuous Glucose Monitoring (CGM).

The seventh relevant article identified in 2021. The study looked into the effect of real-time continuous glucose monitoring (rtCGM) on glucose management in critically ill patients based on the status real-world data are needed (Agarwal et al., 2021). This study looked into evidence on continuous glucose monitoring (rtCGM) on glucose management in real-world. The evidence was generated by 11 patients, the results showed that CGM reduced POC testing by ~60% for patients on insulin infusion (CII). The usage of CGM is early feasibility, considerable accuracy, and meaningful reduction in the frequency of POC glucose testing. The findings of this plot study support the use of rtCGM on critical patients to achieve the glycemic goals.

The eighth relevant article is also a plot study on real-time continuous glucose monitoring (rtCGM) on glucose control and the perceptions of the healthcare providers. The author Kenneth W et al. (Chow, Kelly, Rieff, et al., 2021) proposed this retrospective article aimed to assess the clinical utility and accuracy of rtCGM in managing diabetes patients. The data was analyzed by 11 patients and the results showed a significant glucose decreased by using the rtCGM and a reduction of POC measurements was also be detected. Besides, the majority of nurses reported that rtCGM was helpful for improving care during the COVID-19 pandemic, and it can reduce the use of personal protective equipment (PPE). The study provides a strong rationale to increase clinician awareness for the adoption and implementation of rtCGM systems in the ICU. Results are summarized in tables 1.1 and 1.2.

Discussion

The eight included articles put forth the following

evidence.

First, during the pandemic, all the studies showed continuous glucose monitoring (CGM) proved a considerable benefit in glucose control for critical patients although the evidence is from a small sample patient. The continuous glucose monitoring can track blood glucose levels automatically. Healthcare providers and patients can review the glucose changes over a few hours or days directly to see the trends so as to make more informed decisions to maintain the glucose level.

Second, four studies concerned the accuracy. Although FDA-approved CGMs (Dexcom G and Freestyle Libre) for nonadjunctive use in the hospital settings because of the pandemic, there are specific concerns that several factors may affect CGM performance in the ICU, including changes in tissue perfusion or edema, hydration, acid-base balance, and medication interference(Faulds et al., 2021) and thus limited its usage in ICU. However, early feasibility and considerable accuracy were demonstrated and a rationale increase for the adoption and implementation of rtCGM systems in the ICU was recommended.

Third , some of the studies also mentioned other benefits such as meaningful reduction in the frequency of POC glucose testing, a reduction of nursing and staff workload as well as help conserve personal protective equipment and minimize unnecessary staff exposure in the setting of COVID-19.

Besides, devices were also identified. In 2021,2 CGMs (Dexcom G and Freestyle Libre) were FDA-approved for nonadjunctive use in the outpatient setting but no advice for inpatient. Six studies used the Dexcom G6 device and two studies only stated used a rtCGM devices with limited details.

However, the eight articles present some limitations.

One is that all of the studies come from the USA and the CGM device were mainly FDA-approved. The benefit of the usage of CGM in critical patients still need to be demonstrated in other countries and other devices.

Another limitation is that the number of patients included in each study was low with no more than thirty or even a case report which limits the reliability of the findings of each study. Further studies with larger sample size will be suggested. The small sample size may be related the limited usage of CGM in critical patients. Before the COVID-19 pandemic, the usage of CGM in ICU was under ongoing discussion but very few related studies were available. All of the included studies are primary research and they all provide important developments for the application of CGM intervention in critically ill patients, especially during the COVID-19 epidemic and provided considerable benefits.

Future research should seek to confirm the identified benefits in larger sample sizes, in other Countries besides USA, the use of other devices and add evidence on economic impacts.

NO.	Article Title	Authors/Country	Year	Key Findings	Monitoring Device
1	Use of Continuous Glucose Monitoring to Assess Parenteral Nutrition–Induced Hyperglycemia in an Adult Patient With Severe COVID-19	Kenneth W Chow, et al USA	2020	The usage of rtCGM in the critical COVID-19 patient can treat PN-induced hyperglycemia and help conserve personal protective equipment and minimize unnecessary staff exposure	Dexcom G6
2	Continuous Glucose Monitoring in Critically Ill Patients With COVID-19: Results of an Emergent Pilot Study	Archana R Sadhu,Ivan Alexander et al USA	2020	CGM is feasible in critically ill patients and has acceptable accuracy to identify trends and guide intermittent blood glucose monitoring with insulin therapy	Medtronic Guardian Connect and Dexcom G6 CGM systems
3	Continuous Glucose Monitoring in the Operating Room and Cardiac Intensive Care Unit	Perez-Guzman MC, Duggan E, Gibanica S, Cardona S, et al USA	2021	CGM use is helpful in the ICU to guide therapy in patients that require contin- uous insulin infusion to maintain glucose control	Dexcom G6 CGM (Dexcom, San Diego, CA)
4	Use of Continuous Glucose Monitor in Critically Ill COVID-19 Patients Requiring Insulin Infusion: An Observational Study	Eileen R Faulds,Andrew Boutsicaris,Lyndsey Sumner,L et al USA	2021	CGM using a hybrid protocol is feasible, accurate, safe, and has potential to reduce nursing and staff workload	Dexcom G6 (San Diego, CA)

Table 1.1 Continuous Glucose monitoring on Covid-19 patients and monitoring devices

NO.	Article Title	Authors/Country	Year	Key Findings	Monitoring Device
5	Remote Continuous Glucose Monitoring With a Computerized Insulin Infusion Protocol for Critically Ill Patients in a COVID-19 Medical ICU: Proof of Concept	Georgia M Davis,Eileen Faulds,Tara Walker,Debbie et al USA	2021	A hybrid protocol integrating real-time CGM and POC is helpful for managing critically ill patients with COVID-19 requiring insulin infusion	Dexcom G6)
6	Use and Accuracy of Inpatient CGM During the COVID-19 Pandemic: An Observational Study of General Medicine and ICU Patients	Rebecca Rick Longo,Heather Elias,Mehvish et al USA	2021	The use of CGM is a reasonable alternative to standard of care to achieve the goal of reducing healthcare professional exposure	Dexcom G6, Dexcom, San Diego, CA, USA)
7	Continuous Glucose Monitoring in the Intensive Care Unit During the COVID-19 Pandemic	Agarwal S, Mathew J, Davis GM, Shephardson A, Levine A,et al USA	2021	The use of rtCGM demonstrated early feasibility, considerable accuracy, and meaningful reduction in the frequency of POC glucose testing	G6 sensor
8	Outcomes and Healthcare Provider Perceptions of Real-Time Continuous Glucose Monitoring (rtCGM) in Patients With Diabetes and COVID-19 Admitted to the ICU	Kenneth W Chow,Danielle J Kelly,Mary C et al USA	2021	rtCGM was helpful for improving care for patients and reduced their use of personal protective equipment (PPE).	Dexcom G6 system (Dexcom, Inc., San Diego, California)

Table 1.2 Continuous Glucose monitoring on Covid-19 patients and monitoring devices

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ORIGINAL RESEARCH ARTICLE

A Study on the Roles of Online Social Tools for the Prevention and Control of Covid-19 Pandemic: The case of WeChat

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Keywords: Covid-19, online social tools, grassroots governance, intervention and control, Wechat, Pandemic, social media and health

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ABSTRACT

Background:

In recent years, especially during the Covid-19 pandemic period, online social tools have been widely used involving the fields including medical treatment, education, healthcare, governance, etc. What kind of functions do online social tools play for the prevention and control of the pandemic?

Objectives:

The main purposes of this article are to explore further the roles of online social tools, taking a most popular APP in Asia, that is Wechat, as an example, and to clarify the relevance of different social tools in different countries.

Methods:

By deep participatory observation and using the method of case study, the authors conducted in-depth interviews with 5 community workers, 2 volunteers, and 3 Party member liaisons in Yuejiyuan Community, China. Data collection methods included semi-structured interviews, content analysis.

Results:

The study identifies that online social tools play an important role in the prevention and control of the Covid-19 pandemic, which can be summarized as information dissemination and guidance, psychological counseling, emotional resonance and support, convenience and benefit to citizens. Additionally, this study reveals the powerful community governance by local and the central governments.

Main Contribution to Evidence-Based Practice:

The article puts together recent evidence from recent fieldwork on the Roles of Online Social tool for Community Governance in the Prevention and Control of Covid-19 Pandemic to support clinical decision-making and evidence-based practice. It is helpful to give effective suggestions for policy formulation and provide practical paths for anti-epidemic practice.

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What do we already know about this topic?
It has become a research hotspot in recent years by putting the role of online social tools in the context of pandemic prevention and control. Researchers probe the advantages of online social tools from different aspects, specifically in areas such as education, healthcare. The other research hotspot is the research on specific types of online social tools. There is related research on WeChat, Weibo in China. There is also related research on Twitter.

What is the main contribution to Evidence-Based Practice from this article?
This article is an update on recent evidence on the subject. Through in-depth interviews and participatory observation, a large amount of first-hand data was collected. The latest evidence from recent field work on the roles of Wechat in community governance in the prevention and control of the Covid-19 pandemic was compiled to support follow-up recommendations for Evidence-Based practice.

What are the implications towards theory, practice, or policy?
The article contributes to a better understanding of the role and value of online social tools in the field of pandemic prevention and control. Additionally, evidence is collected through empirical research to provide a basis for government decision-making and pandemic prevention practice.

Authors' Contributions Statement: Cui, Su and Wang conceptualized and drafted the article.

The rapid development of online social tools has been widely used in various fields, including education, health care, etc. Most research on the role of online social tools starts from the perspective of network social needs. It has been claimed that online social tools extend interpersonal communication in social life (Bao, Shi, & Zhang, 2009), and can help ease the pressure of interpersonal communication (Qiao, 2012). José Antonio García del Castillo claims that online social tools play an important role in preventing diseases and promoting the health of infectious diseases, especially in sexual health, physical Image, especially dietary habits and overweight, as well as areas such as smoking and alcohol dependence (Castillo, et al 2020). Due to the needs of pandemic prevention and control, online social tools play to their advantages and become a relevant dimension in the prevention and control of the Covid-19 pandemic.

Literature Review

The topic has become a research hotspot in recent years due to the role of online social tools in the context of pandemic prevention and control. Researchers probe the advantages of online social tools from different aspects. In the area of education, the use of online social tools for teaching can make up for the shortcomings of traditional teaching models, break the limitations of time and space, and deal with difficulties such as limited resources during the period of pandemic (Li, L.Y., & Li, S., 2021). In the healthcare sector, some researchers believe that social media have an amazing speed of transmission, coverage and penetration, and they also play a big role in disseminating information during the prevention and control of COVID-19 (Ahmad & Murad, 2020). In the mental health field other authors (Shah, S. G. S, Nogueras D et al, 2020), claim that online social tools illustrate ways to cope with lockdown associated loneliness in the pandemic, and provide the tools to strengthen the most vulnerable bonds with loved ones and society, while reducing loneliness by reason of social distancing and lockdowns during the COVID-19 crisis.

As far as studies on the types of online social tools, there are some inspiring findings. Twitter has been widely used in clinical practice; social media analysis tools have strong analytical capabilities and can more effectively evaluate sexual health interventions. (Torrentea, Martí, & Escarrabill, 2012). New social media tools such as Weibo, QQ, and WeChat have quickly seized the opportunity of public opinion dissemination, gain user trust in the shortest time, and lead the situation to develop in a positive direction (Dong & Chen,2013). Some researchers have studied a specific network social tool to analyze its operating mechanism and explore its role. Authors Li Xinxiao and

others demonstrated that WeChat, as a public platform, provides remote services for teachers and students in Shanghai universities during the period of pandemic prevention and control in China, popularizing pandemic prevention knowledge, and conducting online education (Li, X.X., & Liu, H., 2021).
From the comparison between general online social tools and particular types of online social tools, we can determine a more encouraging and more conducive analysis from the latter. So, this study focuses on the concerns of Wechat as the most popular online social tool in China. WeChat, as a mainstream social media tool, has a large number of users which can be accounted to 1.283 billion internationally by the end of March/2022.

Case Introduction

The sudden outbreak of the Covid-19 Pandemic has brought an additional difficulty of social research, specifically for conducting large-scale data collection. The community, as the smallest governance unit and the most active place of life, contributes a lot to the intervention and control of the Covid-19 Pandemic worldwide. In this study, the Yuejiyuan community is the field research site. Yuejiyuan Community is a community located in Jiefang District, Jiaozuo City, Henan Province, covering 1.2 square kilometers, with 2739 households and 8517 residents. Affected by the Covid-19 Pandemic, the community also implemented closed management strategy like many other local communities in China. Thus, the mobility of the residents was limited. The authors participated in the voluntary work of pandemic prevention and control in the community in July 2021, meanwhile conducted observation and interviews to collect research data and understanding on the use of Wechat.

Sampling and Participants

Through snowball sampling, the authors identifed 15 research particpants in the community. After explanation of the study purpose, a total of 10 subjects were willing to be interviewed, among whom 5 were community workers, 2 local party members and 3 volunteers.
Concurrently, we also used the research paradigm of network ethnography to sort out some news, videos and notifications forwarded or pushed by community WeChat groups or by participant's Wechat moments, aiming at a more comprehensive understanding of the role of online social tools under the Covid-19 Pandemic prevention and control.

Table 1 Basic Information of Community Respondents

Number	Code	Identity
01	A1	Community Worker
02	B2	Community Worker
03	C3	Community Worker
04	D4	Community Worker
05	E5	Community Worker
06	F6	Party Member Liaison
07	G7	Party Member Liaison
08	H8	Anti-pandemic Volunteers
09	I9	Anti-pandemic Volunteers
10	J10	Anti-pandemic Volunteers

Brief Introduction of Data Analysis

After collection of the first-hand data, we selected the funnel model to process and analyze the data and adopted the grounded theory as the research strategy. Firstly, interviews data was screened, and then the interviews data was conceptualized by open coding. Then, through the spindle coding, the conceptualized interview data was classified. Finally, selective coding was carried out to realize the theme structure of qualitative data and explore the roles of WeChat in community governance during the Covid-19 Pandemic.

Information Orientation and Dissemination

As an important source for the WeChat platform, the official account of local government provides users and residents with a powerful information push service. Yuejiyuan community as located in the Liberated Area. As the official account of the Liberated Area, the Window of Liberated Area issues a large number of anti-pandemic articles during the epidemic, such as the involving of the pandemic, the official responses to special events, the treatment of emergency plans, and the reports of anti-pandemic incidents. In addition, when a resident thinks that a pandemic prevention article has the value of distribution, or can arouse resonance, the article is spread out by forwarding and commenting. This can be seen in the field diary of July 3, 2021: 'In the WeChat group, people are forwarding the official account pushing on pandemic updates every day. The community's pandemic prevention measures are released the first time on the Window of

Liberated Area. '

Because Wechat groups are established according to the mutual interests, business relationship, blood lineage and geographical relations etc, the members of the group are stable. In the fieldwork site, it has been found that the discussion of the WeChat group concentrated on the prevention of the Covid-19 Pandemic in the community, and community residents pay more attention to the impact of the Covid-19 Pandemic on themselves. In the discussion developed in community groups, the final foothold was in the governance of the community, including community governance policy, access to personnel information, pandemic situation, etc. 'Our pandemic prevention needs to hear the voices and needs of the mass,' it is said by C3: 'We have a WeChat group for community residents where we discuss real issues facing the community and our control strategies in the Covid-19 pandemic.' Additionally, community workers established a work group for pandemic prevention and control to push pandemic-related notifications and work arrangements. This point can be verified in the interview content of D4: ' Our community has built several groups, there are large groups of residents in the community, there are volunteer work communication groups, there are party members liaison group and community staff group. So, the ordinary policy release, data statistics and reporting was accomplished through online Wechat groups. 'The conjunction of information dissemination through official account is the speedy spread of disinformation or rumors. In fighting with the disinformation and rumors, the local community workers develop a quick respond mechanism. Just like D4 said in the interview, during the Covid-19 Pandemic, there are a huge amount of rumors which can affect the residents mindset. So, whenever there is information sharing in the group, we will verify it by tracing the source of it and report to superior management department for the authenticity of the information. If it is authentic, it can be spread. If it is false, the source of the information will be blocked, and the disinformation will be cleared. In this way, we can reduce the panic of community residents.' This mechanism prevented residents from spreading any false information concerning the pandemic prevention measures.

Emotional Resonance and Support

After nearly one month's fieldwork, it was found that even in the same community, face-to-face communication was relatively difficult. As a consequence of lockdown or compulsory quarantine, which could happen whenever there was a new confirmed case in the local area, the residents were prone to experience negative emotions, which were posted through Wechat. Those negative public opinions were not conducive to the pandemic prevention and control. Meanwhile, the residents maintained contact with other individuals outside the community, not only maintaining emotional connection but also alleviating uneasiness through Wechat. Therefore, full attention to the positive role in emotional governance was given, and the striving to create a good environment for public opinion are crucial as also argued by other authors (Tang, & Wang,2019).

As interviewee E5 said, ' Our official account has posted some positive energy videos and the employees transfered them to Wechat Groups and the populace, in order to spread positive energy online and alleviate negative emotions. ' All those endeavors were aiming at helping to encourage morale, enhance confidence and better adapt and prepare to post-pandemic life. There was also a considerable number of reports on volunteer work, aiming to encourage the public to participate in the voluntary work of the Covid-19 Pandemic prevention and control, and enhance the public's social responsibility and sense of belonging. Through the interaction on WeChat, people could find their way to solve their confusion, learn from the advanced experience of others, interact effectively with others, produce emotional resonance, support each other emotionally, and find better solutions in communication.

Psychological Counseling

' During the period, everyone was more anxious. Some people complained in the group or did not cooperate with work. (F6). ' To cope with this challenge, the community committee organized psychological consultants and college students as assistants to form volunteer teams for the first time, and also to establish psychological support. WeChat group which could perform psychological counseling online to anyone who needed it. Psychological consultancy supplied one-to-one counseling services to the members of

the group and post effective psychological advice to the group.' Apart from the professional advice, there were spontaneous and nonprofessional form of psychological support. The strong sense of intimate relationship among members was the key factor to successful support. Through video chat, voice bar and texting services, which are offered through Wechat, relatives and friends can comfort each other and maintain close contacting. Local residents can obtain reliefs and alleviate the psychological discomfort state mainly by these two approaches.

Convenience and Benefit to the Local People

For the sake of reducing the spread risk of the pandemic, the passage of residents was controlled through travel code and health code which could reveal the owner's daily activity routine and the possibility of contagion at the entrance of the community. ' Our community has launched a one-code pass. Through the scanning function of WeChat, the travel code and health code are combined, so that it is particularly convenient for residents to check in and out', A1 said. The combination and upgrading of the QR code bring great convenience to the local people. Furthermore, the local people can deal with various businesses with remaining indoors through the Wechat official account. For example, in the service function of the Medical Security Bureau of the Liberated Areas, there is a hyperlink to the Wisdom Society, which offers five kinds of insurance and fund services. All could be processed online. Including the booking of nucleic acid test and the filing of travel activity, a number of control activities could be handled by different options and procedures released by Wechat.

Discussion

WeChat, as a favorite and powerful online social media tool, has endowed four roles which were: 1) information, orientation, and dissemination; 2) emotional resonance; 3) psychological counseling; and 4) convenience and benefit to the populace. It is exceedingly useful for timely updating Covid-19 Pandemic trends in the administration area and carrying out the most suitable Covid-19 Pandemic prevention arrangements according to the changing condition. In this sense, Wechat was essential to the local governance, to the maintenance of social order and social control during Covid-19 Pandemic.

Despite the fundamental roles that Wechat played, some disadvantages also need to be mentioned. Because of the real-name certification requirement of Wechat, there were some violations against people's privacy. Additionally, with the powerful and vigorous censorship of Wechat (similar to that of twitter, Google and Youtube), the daily activities and speech online developed by the residents were also under strict supervision. It has become obvious that Wechat, as all key online social tools used around the world during this period, can become a compelling instrument of control which may pose threats to human rights.

In spite of all successful aspects, during the fieldwork undertaken for nearly a month, the authors of this study found certain issues which deserve some concerns. Firstly, the Wechat is not friendly to the elderly population. It is quite challenging for the aging people to use Wechat to obtain the necessary services. Secondly, the function of WeChat is limited. Nowadays, nucleic acid reservations and vaccine vaccination can be achieved through WeChat, but there are still some deficiencies in the registration of return home information and pandemic risk warnings. In many places, the registration of return information relies on WPS files and WeChat dialog boxes.

In the future, WeChat functions should be further optimized, the return home information registration function and a pandemic risk automatic information push function should be established. It is even possible to establish a national unified nucleic acid reservation and vaccine vaccination platform to break regional differences and achieve national information and function sharing. In addition, the psychological counseling function of WeChat can only be realized through WeChat groups and circles of friends, and its psychological counseling effects and scope are limited. This can be improved by establishing online psychological counseling services.

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ORIGINAL RESEARCH ARTICLE

On the Correlation between successful aging and Traditional Chinese Medicine: Impacts on the quality of life of elderly diabetic patients.

Jie Yu[1], Hong Ji [1*], Wenxiu Ding [2], Yeqing Wang [1], Change Li [1]

Keywords: elderly; diabetes; successful aging; Traditional Chinese Medicine constitution; quality of life; community.

ABSTRACT

Aims and objectives

To investigate the correlation between successful aging (SA) and Traditional Chinese medicine (TCM) constitution and quality of life (QOL) in elderly diabetic patients.

Design

This was a cross-sectional study in elderly patients with T2DM.

Methods

The convenience sampling method was used to recruit elderly patients with T2DM at the Community Health Service Center, from May to August 2019. The study methods were compliant with the Strobe checklist (See Supplementary File 1).

Result

The average score of SA was 58.0±7.7 points in 143 participants. The factors associated with SA were sex, education, way of living, drinking habits, exercising, sleeping, health condition, and participation in social activities. The elderly diabetic patients with Yin-Yang harmony had the highest score of SA. The elderly diabetic patients with Yin-Yang harmony had the highest score of QOL in all dimensions. The score of SA was positively correlated with QOL in all dimensions (total score: r=0.498, P<0.001; subscores: r=0.281-0.550, all P<0.05).

Conclusions

The status of the SA of elderly diabetic patients in the community was moderate. TCM constitution, QOL, and SA were correlated with each other.

Main Contribution to Evidence-Based Practice:

This study indicated that the TCM constitution, QOL, and successful aging were correlated. The more balanced the TCM constitution of elderly diabetes patients was, the higher their scores of QOL and successful aging were.

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What do we already know about this topic?

• The occurrence and development of elderly patients with type 2 diabetes are closely related to the TCM constitution. TCM could be used in the management of elderly patients with type 2 diabetes to improve their QOL.

• Scholars are actively exploring the methods of intervention to promote successful aging, but there is no research on the methods of TCM intervention to promote successful aging.

What is the main contribution to Evidence-Based Practice from this article?

This study indicated that the TCM constitution, QOL, and successful aging were correlated with each other. The more peaceful the TCM constitution of elderly diabetes patients was, the higher their scores of QOL and successful aging were.

What are your research's implications towards theory, practice, or policy?

We should actively explore and develop TCM nursing intervention methods to promote successful aging, improve QOL in elderly diabetic patients, which is also in line with the current health policy situation, and provide a theoretical basis for relevant departments to formulate health care policies for the elderly.

Author' Contributions Statement:

Determine topic selection: Jie Yu, Hong Ji; Investigation: Jie Yu, Yeqing Wang, Change Li; Methodology: Jie Yu, Yeqing Wang; Writing—original draft: Jie Yu; Writing—review & editing: Jie Yu, Hong Ji, Wenxiu Ding.

BACKGROUND

Under the influence of the development of positive psychology in gerontology, researchers proposed the concept of "successful aging" (SA), which emphasizes the potential and advantages of the elderly, rather than their diseases, to cope with the challenges of aging (Wu et al., 2017). The concept of SA includes cognitive behavior, perception, control, life satisfaction, ethics, sense of happiness, healthy survival, and many other aspects (Carstensen et al., 2019; Chen et al., 2020). SA has a subjective dimension, and many scholars studied the subjective views and attitudes of the elderly towards SA (Carstensen et al., 2019; Chen et al., 2020).

The world's population is aging, and the life expectancy of the elderly is longer than ever before (World Health Organization et al., 2011). With aging, various health problems are more likely to occur, and the number of patients with chronic diseases is increasing rapidly ("Chronic disease management in ageing populations," 2012; World Health Organization et al., 2011). Therefore, how to improve the quality of life (QOL) in elderly people and how to achieve more SA is an issue of social concern.

Type 2 diabetes mellitus (T2DM) is one of the common chronic diseases among the elderly in the community, with a prevalence rate of 11% in China (Yang, 2018). The occurrence and development of T2DM are closely related to the Traditional Chinese Medicine (TCM) constitution (XN Wang et al., 2019). The phlegm-damp and damp-heat TCM constitution are strongly associated with abnormal blood cytokine patterns and insulin resistance (You et al., 2017). Specific TCM interventions can be used to intervene in the different TCM constitution, improving the symptoms and QOL of the patients. In addition, TCM often has fewer side effects than traditional treatments (Y Liu, 1995; Maciocia, 2015).

TCM constitution provide the possibility to improve QOL and the level of SA of elderly patients with T2DM. Therefore, it is of great significance to study the relationship between the SA of patients with T2DM and their TCM constitution and QOL in order to actively explore the nursing intervention methods to promote the SA through TCM interventions. Therefore, the aim of the present study was to investigate the correlation between SA and TCM constitution and QOL in elderly patients with T2DM in the community.

METHODS

Aims

The aim of the study is to investigate the correlation between SA and TCM constitution and QOL in elderly diabetic patients.

Design

This was a cross-sectional study. The convenience sampling method was used to recruit elderly patients with T2DM at the Community Health Service Center, from May to August 2019.

Sample/participants

The inclusion criteria were: 1) >60 years of age; 2) diagnosed with T2DM according to Standards of Care for Type 2 Diabetes in China (2017 version) (Chinese Diabetes Society, 2018); 3) the ability to communicate with the investigators normally; and 4) informed consent and voluntary participating in this study. The exclusion criteria were: 1) severe cardiovascular or cerebrovascular diseases; 2) liver or kidney function diseases; 3) stroke and limb dysfunction; 4) dementia; 5) mental disorders; or 6) malignant tumors. This study was approved by the Ethics Committee of our hospital.

Data collection

All data were from the questionnaire survey. All participants were required to fill in the general information survey, the Chinese version of the Successful Aging Inventory (SAI), the older version of TCM Constitution Classification and Determination, and the SF-36 scale. The questionnaire was filled in by the participants themselves. If the participants were unable to fill in the questionnaire, the investigators could read out the contents without any induction and fill in the questionnaire for them.

A self-designed questionnaire was used and included basic information such as sex, age, educational level, marital status, number of children, exercising (LY Zhang, 2018), sleeping (LY Zhang, 2018), health condition (Cheng, 2014), monthly income, way of living, drinking habits, smoking habits, eating habits, chronic diseases (diabetes, hypertension, heart disease, cerebrovascular disease, arthritis, chronic bronchitis, emphysema, cervical spondylopathy, and asthma), participation in social activities (LY Zhang, 2018), and self-assessment of SA (Cheng, 2014).

The Chinese version SAI was established based on the middle-level nursing theory of SA by Flood (Troutman et al., 2011) and translated and validated in Chinese by Cheng (Cheng, 2014). There are 20 entries in five dimensions in the scale (intrapsychic factors and survival significance, functional performance mechanism, gerotranscendence, sense of inheritance, and spirituality). The Likert 5-level scoring method is adopted, the corresponding score is 0-4 points, and the total score range is 0-80 points. The higher the score, the higher the degree of SA. The scale has a Cronbach's α coefficient of 0.832 and a split-half reliability of 0.871 (Cheng, 2014).

The older version of TCM Constitution Classification and Determination was simplified based on the TCM Constitution Classification and Determination of the Chinese Society of Chinese Medicine in 2009 and was established by Liu in 2013 (X Liu, 2013). The scale is simplified to 37 entries, including nine subscales of the constitution of Yin-Yang harmony, Qi asthenia, Yang asthenia, Yin asthenia, phlegm-dampness, damp-heat, blood stasis, Qi stagnation, and allergic. Each subscale includes 4-5 entries. Each entry is graded by the Likert 5-level scoring method, and the corresponding score is 1-5 points. The determination criteria are shown in Table 1. The scale has a Cronbach's α coefficient of 0.815 and KMO of 0.772 (X Liu, 2013).

There are 36 entries in eight dimensions in the SF-36 scale, including physical functioning (PF), role-physical (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role-emotional (RE), and mental health (MH). The first four dimensions are for the physical component summary (PCS), and the last four dimensions are for the mental component summary (MCS). It also includes an entry of health transitions (HT) to assess health transitions over the past year. All dimensions are scored in the range of 0-100 points. The higher the score is, the better QOL is. The scale was applied to the elderly population in China. Cronbach's α coefficient was 0.914 by reliability and validity test (Cao et al., 2014).

Ethical considerations

The investigator explained the purpose and method of the study to the participants and obtained informed consent.

Data analysis

SPSS 21.0 (IBM, Armonk, NY, USA) was used for statistical analysis. The general data and the distribution of the constitution types of TCM of the subjects were expressed using frequency and percentage. The t-test, ANOVA, and non-parametric tests were used to analyze the influence of demographic data on SA. ANOVA was used to compare the scores of SA and the scores of QOL in patients with different constitution. The Spearman correlation coefficient analysis was used to analyze the correlation between SA and QOL. Two-sided P-values <0.05 were considered statistically significant.

The score of "intrapsychic factors and survival

Table 1. Criteria for constitution determination

Type of constitution	Criteria	Determination
Constitution of Yin-Yang harmony	- Subscale score of constitution of Yin-Yang harmony ⩾17 points - Subscale scores of the other eight constitutions ⩽8 points	Yes
	- Subscale score of constitution of Yin-Yang harmony ⩾17 points - Subscale scores of the other eight constitutions ⩽ 10 points	Basically yes
	Do not meet the above criteria	No
Biased constitution	Subscale score of the constitution ⩾11 points	Yes
	Subscale score of the constitution = 9-10 points	Likely yes
	Subscale score of the constitution ⩽8 points	No

RESULTS

Characteristics of the participants

A total of 150 questionnaires were handed, and 143 of them were returned and valid for an effective recovery rate of 95.3%. The characteristics of the participants are shown in Table 2. The mean age of the participants was 67.8±6.9 years, 59.4% were male, 64.3% were in the 60-69 age group, 92.3% were married, more than half of the elderly had only one child, and 64.3% thought their health condition was fair.

Status of SA

The total score of SA in the subjects in this study was 35-77 points, with an average score of 58.0±7.7 points.

significance" was 5-32 points, with an average score of 25.6±4.5 points; the score "functional performance mechanism" was 9-20 points, with an average score of 16.6±2.1 points; the score of "gerotranscendence" was 4-19 points, with an average score of 9.7± 2.2 points; the score of "sense of inheritance" was 2-4 points, with an average of 3.9±0.3 points; and the score of "spirituality" was 0-8 points, with an average of 2.2±2.3 points.

Factors influencing SA

The influences of the demographic data on the scores of SA are shown in Table 2. There were statistically

significant differences in the scores of SA in sex, educational level, way of living, drinking habits, exercising, sleeping, health condition, and participation in social activities (all P<0.05). The pairwise comparisons of the influencing factors of SA are shown in Table 3. In terms of educational level, the score of SA gradually increased with the increase in educational level. The score of an educational level below primary school was the lowest and was significantly different from those of junior high school, high school, and university and above. In terms of way of living, the score of the elderly living with spouses was the highest and was significantly different from that of living with children. In terms of exercising, the score of SA of the elderly who often exercised was higher than that of the elderly who seldom exercised and sometimes exercised and was significantly different from that of the elderly who sometimes exercised. In terms of sleeping, the score of SA gradually decreased with the decline of sleeping quality, and there were significant differences in normal sleeping and sometimes insomnia compared with taking sleeping pills. In terms of health conditions, the score of SA gradually decreased with the decline of health conditions, and there were significant differences in the pairwise comparison of self-assessed good, fair, and poor health conditions. In terms of participation in social activities, the score of SA gradually increased with the increase of participation frequency, and there was significantly different between occasional participation and regular participation.

Distribution of TCM constitution types

The distribution of the TCM constitution of participants is shown in Table 4. Each person may have more than two types of constitution (Y Liu, 1995; Maciocia, 2015). The types of TCM constitution in elderly patients with T2DM in the community were mainly biased constitution, such as Yin deficiency, Yang deficiency, and phlegm-dampness.

Scores of SA in different constitution

The scores of the SA of elderly patients with different constitution in each dimension are shown in Table 4. Among the nine constitutions, the elderly diabetic patients with Yin-Yang harmony had the highest score of SA, which was significantly different from those with other biased constitution.

Scores of QOL

The scores of QOL in elderly patients with different constitution in each dimension are shown in Table 5. The elderly diabetic patients with Yin-Yang harmony had the highest score of QOL in each dimension, which was significantly different from those with other biased constitution, except in BP.

Table 2. Characteristics of the participants

	n (%)	Score of SA	P for SA
Sex			0.023
Male	85 (59.4)	59.2±8.0	
Female	58 (40.6)	56.2±6.8	
Age			0.385
60-69 years old	92 (64.3)	58.3±7.4	
70-79 years old	40 (28.0)	58.2±8.4	
80-89 years old	11 (7.7)	54.9±7.1	
Education level			0.034
Below primary school	14 (9.8)	52.8±9.3	
Primary school	12 (8.4)	56.0±7.5	
Junior middle school	26 (18.2)	57.8±7.4	
High school (including technical secondary school)	46 (32.2)	58.3±5.9	
University and above	45 (31.5)	59.9±8.3	
Marital status			0.717
Married	132 (92.3)	57.9±7.9	
Widowed	10 (7.0)	58.0±4.4	
Remarried	1 (0.7)	63.0±0.0	

Table 2 (cont)

Number of children			0.73
One	73 (51.1)	58.3±8.6	
Two	51 (35.7)	57.3±6.9	
Three and more	19 (13.3)	58.4±5.9	
Lifestyle			0.043
With spouse	106 (74.1)	58.9±7.7	
With spouse and children	11 (7.7)	57.3±7.3	
With children	10 (7.0)	52.1±6.0	
Living alone	16 (11.2)	56.4±7.2	
Monthly income			0.065
Below 1000 Yuan	16 (11.2)	53.3±7.8	
1000-2000 Yuan	3 (2.1)	58.0±4.6	
2000-3000 Yuan	16 (11.2)	57.7±8.6	
Over 3000 Yuan	108 (75.5)	58.7±7.4	
Drinking habit			0.024
Yes	34 (23.8)	57.2±7.9	
No	109 (76.2)	60.6±6.4	
Smoking habit			0.427
Yes	27 (18.9)	59.0±6.0	
No	116 (81.1)	57.7±8.0	
Eating habit			0.221
Mainly vegetarian diet	12 (8.4)	55.5±9.0	
Mainly carnivorous diet	1 (0.7)	68.0±0.0	
Reasonable combination of meat and vegetable	130 (90.9)	58.1±7.5	
Exercise			0.028
Rare	11 (7.7)	57.6±8.7	
Sometimes (1-3 times a week)	39 (27.3)	55.6±7.8	
Frequent (> 3 times a week)	93 (65.0)	59.4±7.1	
Sleep patterns			0.037
Normal	81 (56.6)	58.8±7.1	
Sometimes insomnia	41 (28.7)	58.4±8.2	
Frequent insomnia	10 (7.0)	56.1±7.8	
Taking sleeping pills	11 (7.7)	52.0±7.5	
Number of chronic diseases			0.83
1	50 (35.0)	58.0±7.3	
2	46 (32.2)	58.5±8.0	
3	31 (21.7)	57.9±8.3	
4	12 (8.4)	56.9±6.9	
5	3 (2.1)	53.3±3.8	
6	1 (0.7)	64.0±0.0	
Health condition			0.006
Very good	5 (3.5)	59.8±7.8	
Good	34 (23.8)	61.1±7.1	
Fair	92 (64.3)	57.4±7.3	
Poor	12 (8.4)	52.7±8.6	

Table 2 (cont)

Participation in social activities			0.043
Occasional	110 (76.9)	57.1±7.8	
Few	10 (7.0)	58.5±5.5	
Sometimes	8 (5.6)	62.0±4.3	
Often	15 (10.5)	62.1±7.7	
Self-assessment of SA			
Very consistent	9 (6.3)	-	
Consistent	60 (42.0)	-	
Fair	58 (40.6)	-	
Not consistent	16 (11.2)	-	

SA, successful aging.

Table 3. Pairwise comparisons of the influencing factors of SA

Entry	Grouping	MD	P
Educational level	Between primary school *vs* below primary school	-3.214	0.276
	Between below primary school *vs* junior high school	-5.022	**0.045**
	Between below primary school *vs* high school (including technical secondary school)	-5.475	**0.018**
	Between below primary school *vs* university and above	-7.148	**0.002**
Lifestyle	Between living with a spouse *vs* living with spouse and children	1.576	0.508
	Between living with a spouse *vs* living with children	6.749	**0.007**
	Between living with a spouse *vs* living alone	2.474	0.221
Exercise	Between seldom *vs* sometimes	1.930	0.448
	Between seldom *vs* often	-1.874	0.430
	Between sometimes *vs* often	-3.804	**0.008**
Sleep patterns	Between normal sleeping *vs* sometimes insomnia	0.351	0.807
	Between normal sleeping *vs* often insomnia	2.690	0.286
	Between normal sleeping *vs* taking sleeping pills	6.790	**0.006**
	Between sometimes insomnia *vs* taking sleeping pills	6.439	**0.013**
Health condition	Between good *vs* fair	3.664	**0.015**
	Between good *vs* poor	8.422	**0.001**
	Between fair *vs* poor	4.757	**0.038**
Participation in social activities	Between occasional participation *vs* seldom participation	-1.373	0.581
	Between seldom participation *vs* sometimes participation	-4.873	0.079
	Between occasional participation *vs* regular participation	-5.006	**0.017**

SA, successful aging; MD, mean difference.

Table 4. Scores of SA in the elderly patients with different constitutions

Type of constitution	Number of cases (%)	SA score	Dimension 1	Dimension 2	Dimension 3	Dimension 4	Dimension 5
Constitution of Yin-Yang harmony	13 (9.1)	65.8±4.0	29.7±1.6	17.9±1.1	11.6±2.2	4.0±0.0	2.5±1.6
Constitution of Qi asthenia	16 (11.2)	51.9±6.8*	22.3±6.2*	15.4±2.0*	8.9±2.0*	3.7±0.5	1.6±2.0
Constitution of Yang asthenia	37 (25.9)	58.4±5.9*	26.0±4.5	16.3±1.5	9.5±1.8	3.9±0.4	2.9±2.4
Constitution of Yin asthenia	71 (49.7)	57.5±6.9*	25.5±3.7	16.3±2.1	9.7±2.3	3.9±0.3	2.1±2.3
Constitution of phlegm-dampness	36 (25.2)	55.3±7.6*	24.3±5.3*	15.7±2.0	9.3±2.1*	3.9±0.4	2.1±2.2
Constitution of damp-heat	21 (14.7)	54.2±8.1*	24.8±6.2	15.7±2.9	8.9±2.1*	3.8±0.4	1.0±1.5
Constitution of blood stasis	2 (1.4)	49.0±0.0	23.50±0.71	14.00±1.41	8.00±1.41	3.50±0.71	0.00±0.00
Constitution of Qi stagnation	8 (5.6)	49.5±6.4*	20.1±6.5*	15.3±2.6	9.0±2.0	3.6±0.5	1.5±2.3
Allergies constitution	2 (1.4)	54.5±7.8	25.5±3.5	14.0±0.0	8.0±1.4	3.0±0.0*	4.0±5.7
P		<0.001	<0.001	0.011	0.017	0.001	0.045

Each person might have more than two types of constitution. Dimension 1: "intrapsychic factors and survival significance"; dimension 2: "functional performance mechanism"; dimension 3: "gerotranscendence"; dimension 4: "sense of inheritance"; and dimension 5: "spirituality". SA, successful aging.

*, compare with Constitution of Yin-Yang harmony, difference was statistically significant (P< 0.05).

Correlation between SA and QOL

The scores of SA were positively correlated with QOL in all dimensions (all P<0.05) (Table 6).

DISCUSSION

TCM constitution are associated with T2DM (You et al., 2017). TCM could be used in the management of elderly patients with T2DM to improve QOL (Y Liu, 1995; Maciocia, 2015). Therefore, this study aimed to investigate the correlation between SA and TCM constitution and QOL in elderly diabetic patients in the community. The results suggest that the status of the SA of elderly diabetic patients in the community was moderate. TCM constitution, QOL, and SA were correlated with each other. This is of significance to explore the nursing intervention methods to improve QOL and promote SA in the elderly.

The average score of SA in this study was 58.0±7.7 points, which was lower than that of the studies by Troutman et al. (Troutman et al., 2011) and Hu et al. (Hu et al., 2019), but higher than that of Lin et al. (Lin et al., 2018), indicating that the status of SA in this study was at a moderate level (Hu et al., 2019). In the self-assessment of SA in the general information table, although the elderly diabetic patients had T2DM and other comorbidities, 6.3% of them thought that they were well fit, and 42.0% of them thought that they were fit, which was consistent with the results of Amin et al. (Amin, 2017) that the subjects regarded disease and disability as normal components of aging. Nevertheless, Whitley et al. (Whitley et al., 2016) showed that the self-assessment results of the elderly do not match the results of objective measurements. This indicates that the scale on SA should have a subjective dimension as well as an objective dimension, and the self-assessment of the elderly is of great significance to evaluate SA. Therefore, researchers should pay full attention to understand the views of the elderly on SA.

The influencing factors of SA in this study included sex, education level, way of living, drinking habits, exercising, sleeping, health condition, and participation in social activities. In terms of sex, the SA of males was better than that of females, which was consistent with the literature (Hank, 2011; Li et al., 2006), but it is controversial (Bosnes et al., 2017). The reason might be the differences between samples. In terms of education level, the higher the educational background, the

Table 5. Scores of QOL in elderly patients with different constitutions

Constitution	PF	RP	BP	GH	VT	SF	RE	MH
Yin-Yang harmony	90.0±10.0	92.3±27.7	81.9±17.3	63.5±12.4	83.9±6.2	99.0±3.5	100.0±0.0	81.9±6.7
Qi asthenia	73.4±15.5	51.6±41.3*	59.5±23.0	38.4±13.1*	69.1±14.2*	81.3±21.9	70.8±45.3	67.0±14.4*
Yang asthenia	74.1±18.7	78.4±32.4	70.0±19.8	51.5±13.1	77.7±8.4	91.9±25.4	88.3±28.6	78.9±12.0
Yin asthenia	79.3±15.1	82.4±27.8	70.7±21.6	53.0±15.1	77.0±10.0	94.4±16.9	89.7±24.9	76.1±11.1
Phlegm-dampness	71.7±18.6*	72.2±33.2	63.5±22.5	49.2±14.9	74.8±13.0	85.1±20.5	83.3±34.3	73.6±12.4
Damp-heat	76.2±17.6	71.4±37.3	68.6±19.5	47.9±18.0	74.5±13.9	89.3±19.9	81.0±35.9	72.6±14.2
Blood stasis	67.5±3.5	25.0±35.4	41.0±14.1	35.0±0.0	50.0±35.4*	62.5±35.4	50.0±70.7	48.0±11.3*
Qi stagnation	71.3±16.6	43.8±49.6*	61.4±20.0	37.5±14.1*	63.1±16.2*	70.3±24.0	58.3±49.6	60.5±13.6*
Allergies	65.0±21.2	25.0±35.4	52.0±42.4	30.0±14.1	80.0±0.0	87.5±0.0	66.7±47.2	74.0±14.1
P	0.030	<0.001	0.113	<0.001	<0.001	0.004	0.030	<0.001

QOL: quality of life; PF: physical functioning; RP: role-physical; BP: bodily pain; GH: general health; VT: vitality; SF: social functioning; RE: role-emotional; MH: mental health; PCS: physical component summary; MCS: mental component summary.
*, compare with Constitution of Yin-Yang harmony, difference was statistically significant(P<0.05).

higher the score of SA, as supported by previous studies (Bosnes et al., 2017; Garcia-Lara et al., 2017; Hamid et al., 2012). Because of the higher educational level, the elderly might have more cognitive reserve that could provide them with better employment opportunities and more stable economic conditions, and thus their SA status was better. In terms of way of living, the elderly diabetic patients who lived with their spouse had the highest score of SA. The reason might be that living with a spouse has become the most important way of living for the elderly in China, from which they could obtain the support and company of spouse, and thus it is easier to achieve SA. In this study, whether the elderly diabetic patients drank alcohol or not was an influencing factor of SA. The elderly who did not drink alcohol had a higher level of SA, which was consistent with the results of Bosnes et al. (Bosnes et al., 2017). In terms of exercising, regular exercise could promote SA, which was consistent with previous studies (Gutierrez et al., 2018; Ng et al., 2009; Parslow et al., 2011). Exercising could reduce the incidence of falling down, which is an important health issue for the elderly. In addition, some authors believe that exercising is conducive to the physical and mental health of the elderly, thus improving their health level (Cesari et al., 2015). In terms of sleep, elderly diabetic patients with normal sleeping had a higher level of SA. According to Li et al. (Li et al., 2006), people often have difficulty in sleeping with the increase of age, which would reduce their QOL. In terms of health condition, the score of SA of elderly diabetic patients with good self-evaluated health condition was higher than that of general and poor self-evaluated health condition, which was consistent with the results of Whitley et al. (Whitley et al., 2016). In terms of participation in social activities, the elderly diabetic patients who often participated in social activities had a higher score of SA. Active participation in social activities would have an impact on life satisfaction, physical and mental health, and cognition (Canedo et al., 2018), thus affecting the status of SA.

The types of TCM constitution in the 143 cases of elderly patients with T2DM in the community in this study were mainly biased constitution, such as Yin deficiency, Yang deficiency, and phlegm-dampness, and most of the elderly patients had concurrent TCM constitution, which is consistent with the literature (Luo et al., 2019; Zhao et al., 2018). The onset, progression, and prognosis of T2DM were related to biased constitution (XN Wang et al., 2019; You et al., 2017). The scores of SA in elderly patients with different constitution showed that the elderly diabetic patients with Yin-Yang harmony had the highest score of SA, which is supported by Zhang et al. (LY Zhang, 2018). The elderly diabetic patients with Yin-Yang harmony had the highest score of QOL in each dimension, except in BP. A more harmonious constitution of elderly diabetic patients was correlated with a better QOL, as supported by Wang et al. (Q Wang et al., 2007). If the elderly have a higher perception of SA, they would also have a higher life satisfaction (Kars Fertelli & Deliktas, 2019). The results of this study indicated that the TCM constitution, QOL, and SA were

Table 6. Correlation between SA and QOL

SA	PF	RP	BP	GH	VT	SF	RE	MH	Average score of QOL
r	0.287	0.303	0.207	0.457	0.526	0.281	0.392	0.550	0.498
P	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

QOL: quality of life; PF: physical functioning; RP: role-physical; BP: bodily pain; GH: general health; VT: vitality; SF: social functioning; RE: role-emotional; MH: mental health; PCS: physical component summary; MCS: mental component summary.

correlated with each other. The more peaceful the TCM constitution of elderly patients with diabetes was, the higher their scores of QOL and SA were. This suggests that appropriate intervention measures can be taken to
correct the biased TCM constitution of elderly patients with T2DM so that they tend to be peaceful, thus improving their QOL and promoting their SA status. At present, scholars in China and abroad are actively exploring intervention to promote SA (Shirani et al., 2019; Vaccaro et al., 2019; KF Zhang et al., 2017), but there is no research on the intervention method of Traditional Chinese Medicine in promoting SA. This study provides a theoretical foundation for such research in the future.

This has limitations. It was conducted in one community health service center. In addition, the cross-sectional design prevents the determination of any cause-to-effect relationship. Future studies should expand the sample size. Longitudinal studies could provide a better understanding of the changes in SA in time.

CONCLUSIONS

This study indicates that the TCM constitution, QOL, and SA were related to each other. The more harmonious the constitution of the elderly is, the higher the scores of quality of life and SA are. This study is of great significance to explore the nursing intervention methods to improve the QOL and promote SA of the elderly. It provides the government and relevant departments with some theoretical basis for the formulation of healthcare policies.

RELEVANCE TO CLINICAL PRACTICE

These findings suggest that TCM constitution, QOL, and SA were correlated with each other.

Conflict of Interest statement

None declared

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COMMENTARY

On Ethics, Biomedical Education and Health Promotion: International and Chinese Perspectives

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ABSTRACT

Background:
This article is a Commentary that reflects on scientific research and education by exploring a potential social dimension in terms of its implications to population health and public welfare. With particular attention to biomedical technology, it argues that the development of a keen awareness and ethical standards has become a pressing need for social policy to promote scientific social responsibility (SSR) for research and educational institutions. A biopsychosocial view of health and mental health is applied along with an international perspective in relation to China's current ideological and political contexts to indicate the complexity of the issues involved.

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What do we already know about this topic?
The study of population health has drawn huge attention from social scientists and practitioners who are concerned with so-called "social determinants" of population health.
What is the main contribution to Evidence-Based Practice from this article?
This article will explore the subject from a general/global view while also putting it in perspective by considering the current ideological and political contexts of China that have resulted in major social changes in the past decade..
What are the implications towards theory, practice, or policy?
The main issue addressed in this article is the role of scientific undertaking, and biomedical education in particular in promoting individual and societal well-being. The major argument of the article is that scientific research and education contains a social dimension in terms of its implications to population health and public welfare that deserves an ongoing international debate.
Authors' Contributions Statement: Chen and Qin conceptualized and drafted the article

The study of population health has drawn huge attention from social scientists and practitioners who are concerned with so-called "social determinants" of population health. A systems (or systems sciences) approach, however, points to the complex interplay of health-related factors at multiple levels, from biological to societal (Fink, Keyes & Cerdá, 2016). The field of scientific (particularly biomedical) research and education, on the other hand, has seen the rise of SSR (scientific social responsibility) which demands developing linkages between science and society in certain, moral/ethical ways. An old and heated topic for the (philosophical, sociological, etc.) study of science (e.g., Nature, 1935; Butts, 1948), the almighty issue seems to have come back with even more grave concerns since the outbreak of COVID-19, followed by other crises such as deadly nuclear and cyber threats. This article will explore the subject from a general/global view while also putting it in perspective by considering the current ideological and political contexts of China that have resulted in major social changes in the past decade.

FROM CSR TO SSR: A BRIEF REVIEW

Corporate social responsibility (CSR) as a management concept has been used by business organizations (companies) to give back to society while bolstering brand reputation. Its history may be traced back over two centuries, with the birth of "responsible organizations" in the 1800s (Staff Writer, 2019). As a modern practice it emerged in the 20th century, with the term "corporate social responsibility" coined in 1953 by American economist Howard Bowen who is often referred to as the father of CSR (Bowen, 1953). In 1971, the concept of a "social contract" between businesses and society was introduced under the idea of CSR, acknowledging officially that companies function and exist because of public consent and, therefore, there is an obligation to contribute to the needs of society. As more and more companies began incorporating social interests in their business practices while becoming more responsive to stakeholders, the 1990s marked the beginning of widespread approval or universal acceptance of CSR. By the early 2000s, it had become an essential strategy for many organizations (Staff Writer, 2019).

Scientific Social Responsibility (SSR) may be defined as the confluence of scientific knowledge with visionary leadership and social conscience, concerned with building synergies among all stakeholders in scientific knowledge community. The term SSR is analogous to CSR while the former issue was raised and taken seriously in modern literature even earlier as indicated in the beginning of this article. However, the contribution of SSR compared to CSR is minimal at present and not well documented in the literature. Therefore, Samanth and colleagues (2021) conducted a systematic literature review of SSR from year 1947 to 2019 from various fields in order to evaluate SSR. Their findings show that there has been a dramatic increase of scholarly interests in SSR since the 1990s, which is similar to the case of CSR, with attention also from political leaders (e.g., Clinton, 1997). In 2011, Angewandte Chemie International Edition of the German Chemical Society, one of the prime chemistry journals in the world, published an editorial entitled

"Scientific Social Responsibility: A Call to Arms" (Krogsgaard-Larsen, Thostrup & Besenbacher, 2011). In their call for a "preemptive strike", the authors urge that scientists develop a new mindset and regain the trust of society by reinvigorating scientific social responsibility and actively voicing their commitment to it. While CSR may provide some inspiration, they argue, the scientific world is faced with the urgent challenge to design and develop academic leadership as a separate discipline with an emphasis on responsible use of research funds (ibid.).

Broadly speaking, responsible scientific action contains consideration of population health and public welfare at every step, including making choice of what to study, for what purpose, and how to carry it out in a way that is sanctioned by social policy for the sake of social or societal well-being. This has become even more apparent since the outbreak of the COVID-19 pandemic, accompanied by other crises such as deadly nuclear and cyber threats. Here, with particular attention to biomedical technology, the development of a keen awareness and ethical standards is seen as a pressing need for social policy to promote scientific social responsibility for research and educational institutions worldwide.

In Asia, India is currently leading the movement toward SSR, as possibly the first country in the world to implement such a national policy on the lines of CSR. In 2019, a draft of the new Scientific Social Responsibility (SSR) Policy was published by the Department of Science and Technology (DST) of Indian Government, building upon its tradition of earlier policies (e.g., Scientific Policy Resolution 1958, Technology Policy Statement 1983, S&T Policy 2003, Sci-Tech and Innovation Policy 2013). The SSR policy was formally released on India's National Technology Day 2022 with a set of guidelines in order to "create an ecosystem with a two-way engagement between science and society" (Dept. of Science & Technology, 2022). This national experiment is of worldwide interest and deserves international attention. With a focus on biomedical education and health promotion, a further look into the giant case of China will also be provided below with some reflection on continuing development of SSR in more specific institutional and cultural contexts.

SSR APPLIED: BIOMEDICAL EDUCATION AND HEALTH PROMOTION

Biomedical research plays a pivotal role in the advancement of science in the 21st century. Life scientists as educators also share their commitment to SSR by contributing to health promotion, particularly in the biomedical field. From an international perspective, such positive contribution may result from related instructional arrangements by institutions of higher learning. And researchers from various countries have attempted to validate their effectiveness with some empirical evidence.

For instance, Muñoz-Rodríguez and colleagues (2021) conducted a survey to explore the influence of an enrolled degree course on health and eating habits in a population of Spanish university students.[10] Their cross-sectional observational study, by means of a food frequency questionnaire, was carried out with 648 students, and the findings show that the self-reported BMI (body mass index) was higher for the non-biomedical students group, which also reported less regularity in taking meals, eating fewer colored vegetables and fruits, and a higher alcohol intake. In contrast, the proportion of students that showed more interest in the diet-health duality and a desire to adopt healthier habits was larger in the biomedical students' group than in the non-biomedical group. The dietary habits discovered in the study suggest that biomedical students make healthier food choices; additionally, the group of biomedical students took more walks per week (ibid.). Research like this shows that biomedical education, in addition to its scientific purposes, does affect the health behavior of the students with a positive impact on health promotion.

HEALTH ETHICS VS. IDEOLOGICAL/POLITICAL EDUCATION: A CASE WITH CHNESE CHARACTERISTICS

Aside from the potential benefits demonstrated by the kind of research mentioned above, the term "scientific social responsibility" or SSR carries strong moral implications for scientists and science educators. In the biomedical field as well as allied health professions, it is the subject of scientific and health ethics that both researchers and practitioners are exposed and obliged to (Vevaina, Nora & Bone, 1993). There are certain

ethical rules and principles, including non-maleficence, beneficence, respect for individual autonomy, confidentiality, and justice, that appear consistently. Some of the ethical issues may arise in clinical practice anywhere, including informed consent, non-initiation and termination of medical therapy, genetic intervention, and allocation of scarce health resources. However, what can be considered moral and ethical should be further examined within particular, diverse national contexts.

In current China, for example, beyond the usual discussion of scientific and health ethics there is an additional layer that must be considered. That consideration or educational requirement is called Si Zheng in Chinese (in abbreviated form), which means ideological and political education. Aside from courses specifically designed for that purpose, it requires or encourages teaching all other courses from official ideological and political perspectives, or explaining course contents (including science and technology curricula) as much as possible on the ideological and political dimension. Therefore it's also called "ideological education in the curriculum", or "curriculum ideology and politics" (Liang, 2022). The undertaking, which has seen a dramatic rise over the past few years, possesses strong connections to the established Chinese practice of De Yu (moral education) within its educational systems ever since the People's Republic was founded. Its evolution to such a dominating status with the current "state of art" of Si Zheng is worth studying as a renewed case "with Chinese characteristics". While it may sound like something beyond the subject of this article, it is of great relevance to the discussion of SSR in the particular cultural and historical contexts in which we can sense the complexity of the issues involved.

BIOPSYCHOSOCIAL PERSPECTIVES

Bioethics is the discipline of ethics dealing with moral problems arising in the practice of health care and the pursuit of biomedical research (Heyes, 2007). Helping professionals may confront ethical dilemmas regularly in their individual relationships with patients and in institutional/societal decisions on health care policy. Moral problem solving requires the application of certain ethical rules and principles to specific situations while ethical theories also differ in different contexts. Interpretation of the ethical principles and the application of these principles to each clinical situation demands the thoughtful attention of the practitioner. In biomedical education as well as training in all health-related professions, a biopsychosocial perspective may prove to be very helpful for addressing various ethical issues in research and practice.

Available research literature provides plenty of insights that contribute to biological, psychological, and social perspectives regarding biomedical issues on a global scale. Taking alcohol abuse issue for instance, previous clinical studies demonstrated that Asian subjects were more sensitive to alcohol than non-Asian subjects, besides the influences of psychological and social factors. Therefore, lower rates of alcohol abuse found in certain Asian cultures might have a physiological base, thus enriching our understanding with a more comprehensive biopsychosocial view applicable to the study of reaction patterns to biomedical procedures. However, more international comparative studies are needed since different nations may have different patterns of alcohol consumption, which may be more complicated than some simple rates can differentiate and evaluate. Generally speaking, it is the concern of such issues that have given rise to a relatively new field of research in psychosomatic medicine (Lyketsos et al., 2006).

With regard to the psychosocial aspects of health and mental health issues (Macleod & Davey, 2003), theories of stress and coping along with the role of socioeconomic status (SES) have helped to expand our knowledge in terms of the development of psychiatric and social medicine (Holzer et al., 1986). On the other hand, unlike the stress theory emphasizing that social conditions may cause illness, some other approaches such as selection and drift theories argue that health problems cause low social status through a selecting or drifting process. In particular, mental patients in the lower socioeconomic classes were less likely to go to private clinics but more likely to receive severe diagnoses when first seen by healthcare professionals, and more likely to be involuntarily hospitalized. Lower class status might also cause mental health problems through environmental and individual factors; conversely, mental disorders could cause lower socioeconomic status. At an even higher level of theoretical reasoning, the former is associated with the conflict theory while the latter more associated with the functional theory in sociology. All these ideas

and insights would help us achieve a more comprehensive understanding via the biopsychosocial lens when studying a variety of health service and bioethics issues (Chen & Chen, 2021).

It is important to note that cultural issues always operate under certain social conditions. Cultural values and the social structure always mutually influence, constantly adopt and adjust, and may also conflict with each other. Underutilization of healthcare services, for instance, does not necessarily mean lack of needs or problems, but rather an indication that healthcare services may not respond very well to the needs of certain populations (e.g., Asian Americans) (Sue & McKinney, 1975; Chen et al., 2003).

Furthermore, healthcare advocacy is an important tool in the helping professional's arsenal that stands the potential to improve both patient care and the profession (Mullens et al., 2019). However, many professionals feel that they lack the leverage and knowledge to advocate on behalf of themselves, their practices, their patients, and their profession. Yet, as a matter of fact, healthcare professionals are uniquely positioned to advocate based on their clinical acumen, personal experience with patient care, and their position in the healthcare ecosystem value chain. The development of a keen awareness with clear ethical standards, thus, becomes an inherent requirement in our consideration of a potential social dimension in biomedical education.

CONCLUSION AND DISCUSSION

The main issue addressed in this article is the role of scientific undertaking, and biomedical education in particular, in promoting individual and societal well-being. The major argument is that scientific research and education contains a social dimension in terms of its implications to population health and public welfare. With particular attention to biomedical technology, the development of a keen awareness and ethical standards has become a pressing need for social policy to promote scientific social responsibility (SSR) for scientific research and educational institutions. A biopsychosocial view of health-related matters as well as an international perspective on ethical issues in healthcare practice are more important than ever to achieve a higher level understanding. Cultural sensitivity is equally instrumental to the inquiry (Mcnulty & Fincham, 2012), particularly in relation to China's current ideological and political contexts in terms of the complexity of the issues involved. By combining an interest in the social determinants of health with a conceptual framework of SSR for understanding how genetics, biology, behavior, psychology, society, and environment interact (Braveman & Gottlieb, 2014), a systems or systems science approach can inform our understanding of the underlying causes of the distribution of health across generations and populations and can help us identify potential barriers to its achievement. Therefore, it is ultimately important to understand how systems science approaches may make substantive and methodological contributions to the study of population health from a combined science-social science/social affairs perspective. That is why allied health professions such as social work may make a substantial contribution as well.

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ORIGINAL RESEARCH ARTICLE

Community Pharmacists and Promotion of Lifestyle Modification in Adults with Hypertension: A Practice Protocol

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Keywords: Hypertension, practice protocol, promotion of lifestyle modification, community pharmacists, phenomenology

ABSTRACT

Introduction

The growing prevalence of hypertension is a problem of public health importance globally. Lifestyle modification is an important first-step in the management of hypertension requiring promotion by all healthcare professionals. However, there is not enough focus on the contribution of pharmacists towards promotion of lifestyle modification (PLM) in the management of hypertension in Nigeria.

Methods

A phenomenological study involving in-depth interviews of 12 community pharmacists was conducted to explore how community pharmacists promote lifestyle modification in adults with hypertension Lagos, Nigeria and to develop a practice protocol for community pharmacists for guiding the practice of PLM. Participants were purposively selected as key knowledgeable who could give rich and nuanced insights about the phenomenon of PLM and an interview protocol was used to guide the interviews.

Results

From a thematic data analysis conducted, 7 themes emerged to categorize the practice of PLM by community pharmacists among hypertensive adults and the essence of a practice protocol. The themes pertaining to practice were cognitive factors, contextual factors, strategies, and self-efficacy. From the perspectives of the participants, a practice protocol was developed that can serve as a guide to community pharmacists in Lagos while performing the role of PLM among adults with hypertension.

Conclusion

Community pharmacists are well positioned in communities to contribute to reducing the incidence and prevalence of hypertension in Nigeria. The availability of a practice protocol will enhance the performance of community pharmacists while promoting lifestyle modification and can help to standardize the practice of PLM.

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What is already known on this topic?
Promotion of lifestyle modification is the mainstay of preventive care in hypertension and all health professionals must be involved.

Main contribution to Evidence-Based Practice
Community pharmacists promote lifestyle modification based on the perceived benefits to patients, barriers to their role and their self-efficacy. A practice protocol to follow while promoting lifestyle modification in hypertensive adults was developed.

Implications for public health practice
Greater involvement of community pharmacists in PLM would contribute to lowering incidence and prevalence of hypertension in Lagos. This could have positive economic and social implications on families and communities, and reduced healthcare costs for the government. And ultimately contribute to reducing health disparity in Nigeria.

Author' Contributions Statement:
The authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Olanike Kehinde. The first draft of the manuscript was written by Olanike Kehinde, and all authors commented on all versions of the manuscript. All authors read and approved the final manuscript.

Introduction

Hypertension (HTN) is a preventable global public health problem and a risk factor for other noncommunicable diseases (NCDs) including diabetes, stroke, ischaemic heart disease, heart failure and kidney disease (Joseph et al., 2016). It is known to affect more than one billion people in the world and is a leading cause of death globally (Akinlua et al., 2015). In Nigeria, it is reported as the most common cause of morbidity and mortality from cardiovascular diseases with a prevalence as high as 30% (Falase et al., 2015; Pius et al., 2020). The prevalence rose from 22% in 1990 to 28% in 2009, and is projected to rise above 30% by 2030, (Adeloye et al., 2015; Ajayi et al., 2017). HTN may be prevented and controlled through the adoption and maintenance of healthy lifestyles (Joseph et al., 2016; Pius et al., 2020).

According to the World Health Organization (WHO, 2021), NCDs account for 71% of deaths globally and can be averted through lifestyle modification. Lifestyle modification has been shown to have a positive effect on hypertension (Crittenden, Seibenhener, & Hamilton, 2017). The low level of awareness, treatment, and control of HTN in Nigeria necessitates that all healthcare professionals must be involved in its management (Akinlua et al., 2015). In Nigeria and some other African countries, community pharmacists (CPs) are usually the first healthcare professionals consulted for treatment of diseases and other health-related issues and so must be involved in promotion of lifestyle modification (PLM). (Agomo et al., 2018).

PLM entails encouraging attitudinal and behavioral changes towards healthier lifestyle choices that are maintained by the individual for long term. It is a useful nonpharmacological strategy for reducing health disparity and the economic burden due to hypertension in Nigeria. PLM in patients by health professionals including CPs promotes public health but there is poor understanding of how community pharmacists (CPs) in Nigeria contribute to PLM. The use of practice guidelines aids standardization of disease management protocols and the need for such protocols to guide PLM by CPs in the management of HTN has been highlighted in some studies (Dineen-Griffin et al., 2019; Laliberte et al., 2012).

We aimed to provide an understanding of how CPs promote lifestyle modification to reduce the burden of HTN in Lagos, Nigeria and to develop a practice

protocol for CPs for PLM from the expressed knowledge and perspectives of the participants. The expressed perspectives provided answers to two research questions (RQ) bordering on how CPs perform PLM in hypertensive adults and how practical knowledge and pharmacy practice protocol for PLM are revealed from the experiences of the CPs.

Methods

We sought to explore the phenomenon of PLM among adults with HTN using interpretive phenomenology in a qualitative research approach. We used the same method as in a previous study exploring the perspectives of pharmacists about the barriers and enhancers to the practice of PLM (Kehinde, Dixon-Lawson, & Mendelsohn, 2020). Interpretive phenomenology involving purposeful sampling technique of key knowledgeable was used in this qualitative study. 12 community pharmacists (5males and 7 females) practicing in Eti-Osa Local Government area (LGA) of Lagos State, with at least five years' experience, and involved in counseling patients with HTN were selected. CPs who were practicing outside this LGA or who were only involved in administration were excluded from the study.

Procedure

The data collection method involved face to face in-depth interviews lasting between 65minutes and 130 minutes. The interviews involved using a semi-structured protocol (with 10 open-ended questions and 4 sub-questions) designed by the investigator to capture the views of participants about their knowledge and practice of PLM.

The interviews were audio-recorded and later transcribed verbatim manually and by dictation. The constructs of social cognitive theory and health promotion model guided the design of the interview protocol as well as some concepts of PLM gleaned from literature (Laliberte et al., 2012). Credibility was built into the research by prolonged engagement with the data, triangulation, member checking and use of rich, thick descriptions of the data and methods. Approval for the study was obtained from the Institutional Review Board at Walden University (Approval number – 03-14-19-0532338).

Data Analysis

Thematic data analysis was conducted manually using Excel spreadsheets to generate codes, themes, and categories. The process involved data compilation, disassembling, reassembling, interpretation, and conclusion (Castleberry & Nolen, 2018). Word clouds were generated to add to the rigor of the analysis.

Results

Demographics: the participants aged between 30-59 years and had been in pharmacy practice between 9 and 33 years. The length of time in community pharmacy practice ranged between 8 and 25 years, with a duration of practice in Eti-Osa LGA ranging from 2 to 16 years. Their highest qualifications were Bachelor of Pharmacy (5 participants), MSc/MPH/MBA (6 participants) and 1 participant had a postgraduate fellowship (FPCPharm).

From the in-depth interviews rich, thick, and nuanced data were collected about the phenomenon of PLM by CPs. The analyzed data were summarized into 7 themes (4 for RQ1 and 3 for RQ2 respectively). Ensuing themes pertaining to the performance of PLM by CPs were cognitive ability, practice of PLM by community pharmacists, contextual factors, and strategies (Table 1). Cognitive ability bordered on the CPs knowledge of hypertension and promotion of lifestyle modification. It included a definition of hypertension as being consistently elevated blood pressure higher than 130/80mmHg and that it is often termed a silent killer.

The participants highlighted that PLM entails promoting regular exercise, dietary control, reducing stressors, smoking cessation, and reducing alcohol intake. One of the participants explained that he practices PLM by advising smokers to quit, people to eat healthy and balanced meals at the right time, eat only fruits for dinner, reduce fatty foods, reduce alcohol intake and encouraging patients to change from a sedentary lifestyle. Another participant highlighted that PLM involves one on one counseling and explaining the benefits of lifestyle modification to the patient. The need for regular BP measurement and documentation was also stated. The contextual factors involved in PLM included necessary skills, follow-up, documentation, barriers, and environmental factors. The need for effective communication skills and better documentation of the practice by CPs were highlighted in addition to patient factors including

religious and cultural beliefs among the contextual factors at play. The need to leverage on technology Self-care management and lifestyle coaching were among the strategies being used by CPs. A concept diagram was used to represent the factors involved in PLM by CPs (Fig 1).

The 3 themes relating to how pharmacy practice protocol is revealed from the experiences of community pharmacists were self-efficacy, enhancing effectiveness and reach for PLM and community pharmacy protocol for PLM (Table 2).

Practical knowledge of PLM was revealed by affirming and social media to enhance the practice were highlighted in the study.
confidence in their ability to teach subordinates and colleagues how to promote lifestyle modification using a training manual. To enhance their effectiveness and reach for PLM, participants mentioned the need for innovation and value-added services to their clients and the use of technology, social media, handbills, and radio jingles. The need for a practice protocol to standardize the practice of PLM was raised by two of the participants. From the analysis of data, a practice protocol was developed to aid and help standardize the practice of PLM by community pharmacists in Eti-Osa LGA (Fig. 2).

Table 1
Codes, Themes, and Categories about PLM by Community Pharmacists

Code Labels	Themes	Theme Clusters	Quotes
Definition of hypertension Symptoms Prevention Management Complications	Knowledge of hypertension	Cognitive ability	Hypertension is persistently high BP greater than 130/80mmHg; determined after three readings within a month (Participant #2) Often referred to as the “silent killer” (Participant #7)
Community Pharmacists and PLM	Knowledge of PLM		Hypertension is preventable through LM and having regular BP checks. LM entails regular exercise, dietary control, reducing stressors, smoking cessation, and reducing alcohol intake. (Participant #8). Highlighting, and creating awareness about a patient’s role and the changes a patient needs to make to his daily life in order to have a positive impact on his BP and health (Participant #2).
Knowledge	Practice of PLM by community pharmacists	Practice of PLM by community pharmacists	It entails asking smokers to quit, people eating healthy meals; eating at the right time; eating balanced breakfast and lunch; eat only fruits for dinner; reduce fatty foods; reduce alcohol intake and encouraging patients to change from a sedentary lifestyle (Participant #12)
Benefits of LM			The benefit of PLM is that we have fewer numbers of people coming down with hypertension and can help to delay onset of hypertension in patients with a family history of hypertension (Participant #12).

Involvement of Community Pharmacists in PLM			In our pharmacy, we counsel one-on-one on LM and the benefits of adopting healthy lifestyles. We measure BP and record it. Counsel on regular medication use. Other specific counseling points include Exercise up to three to four times in a week for 30-40 minutes at a time. Reduce salt intake; Smokers to quit smoking; Go off alcohol completely; Cut down consumption of fatty foods Stop red meat; Stop coffee, tea and Kola nut; Increase fruit and vegetable intake. Anyone that is obese, to work towards weight loss (Participant #5).
Necessary Skills	Enablers	Contextual factors	Effective communication skills; use IT to document LM activities and counseling. Leverage on technology to improve communication with patients using phone calls and SMS (Participant #4). Free BP checks offered in our pharmacy encourages repeat visits by customers. We compare trends in BP.
Follow-Up			We phone to remind them. Some come on their own to discuss health issues and their medications. We discuss LM when patients come back for repeat visits (Participant #5).
Documentation			Better documentation (Participant #10).
Barriers	Barriers to effectiveness Overcoming Barriers		Patients are sometimes in a hurry; they want to dash in and out because of the hustle and bustle in the city (Participant #4).
Environmental factors	Practice environment		Cultural/religious undertones play out. In parts of Northern Nigeria, a male healthcare professional may not be able to get too close to a female patient (Participant #9).
Social Infrastructure	Social Infrastructure		High vehicular traffic in Lagos contributes to stress (Participant #4)
Strategies	One-on-one counseling, Integrative Pharmacy, Use of practice guidelines for PLM, LM counseling, MI, Lifestyle Coaching, Self-care management, Concordance	Strategies	Two common approaches to PLM are by encouraging exercises and dietary control (Participant #5). The CP should be able to use smart devices that aid LM (Participant #4).

Note. PLM =Promotion of lifestyle modification, LM = lifestyle modification, MI = motivational interviewing

Figure 1 Factors Involved in Promotion of Lifestyle Modification in hypertensive people from the perspectives of community pharmacists.

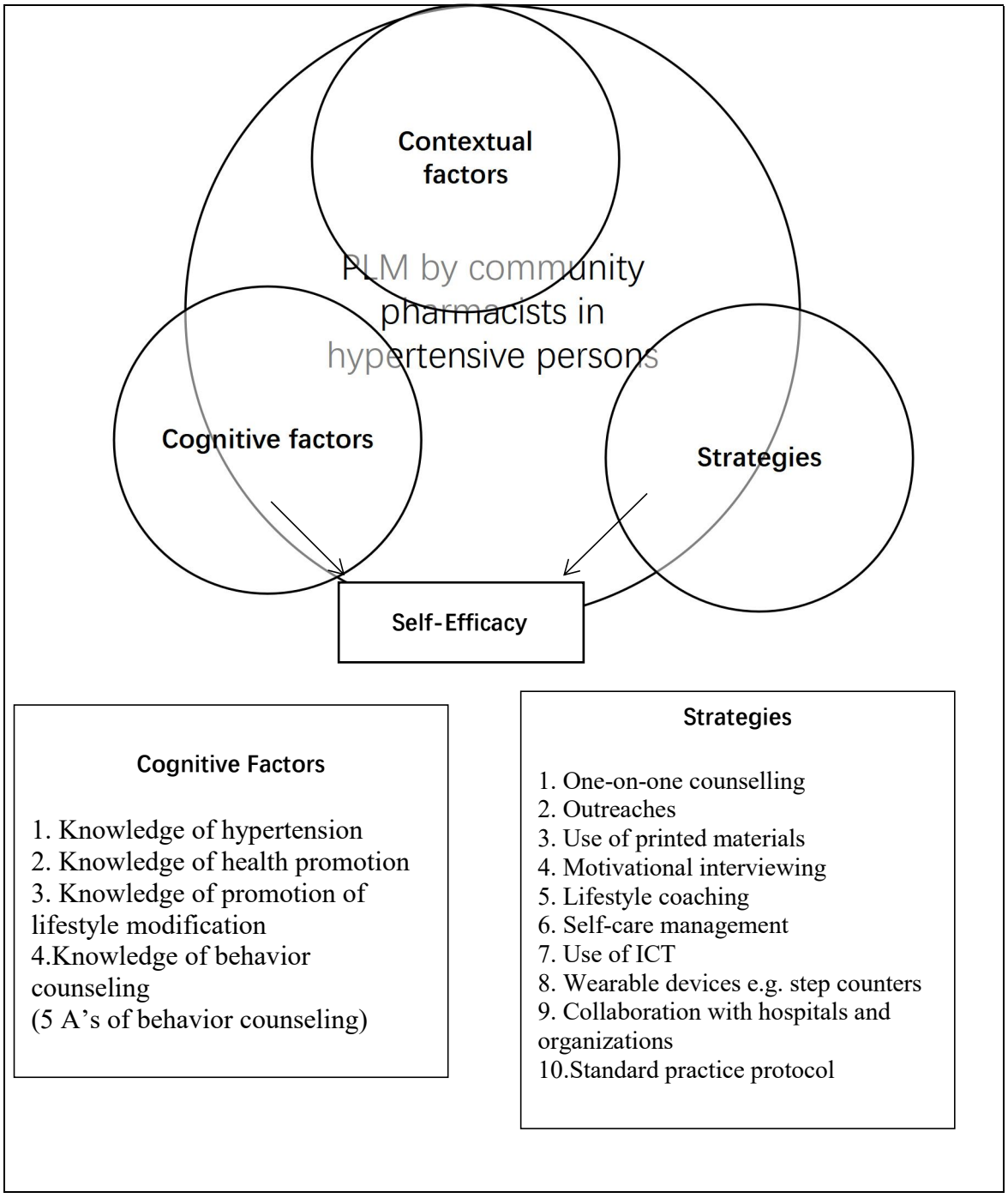
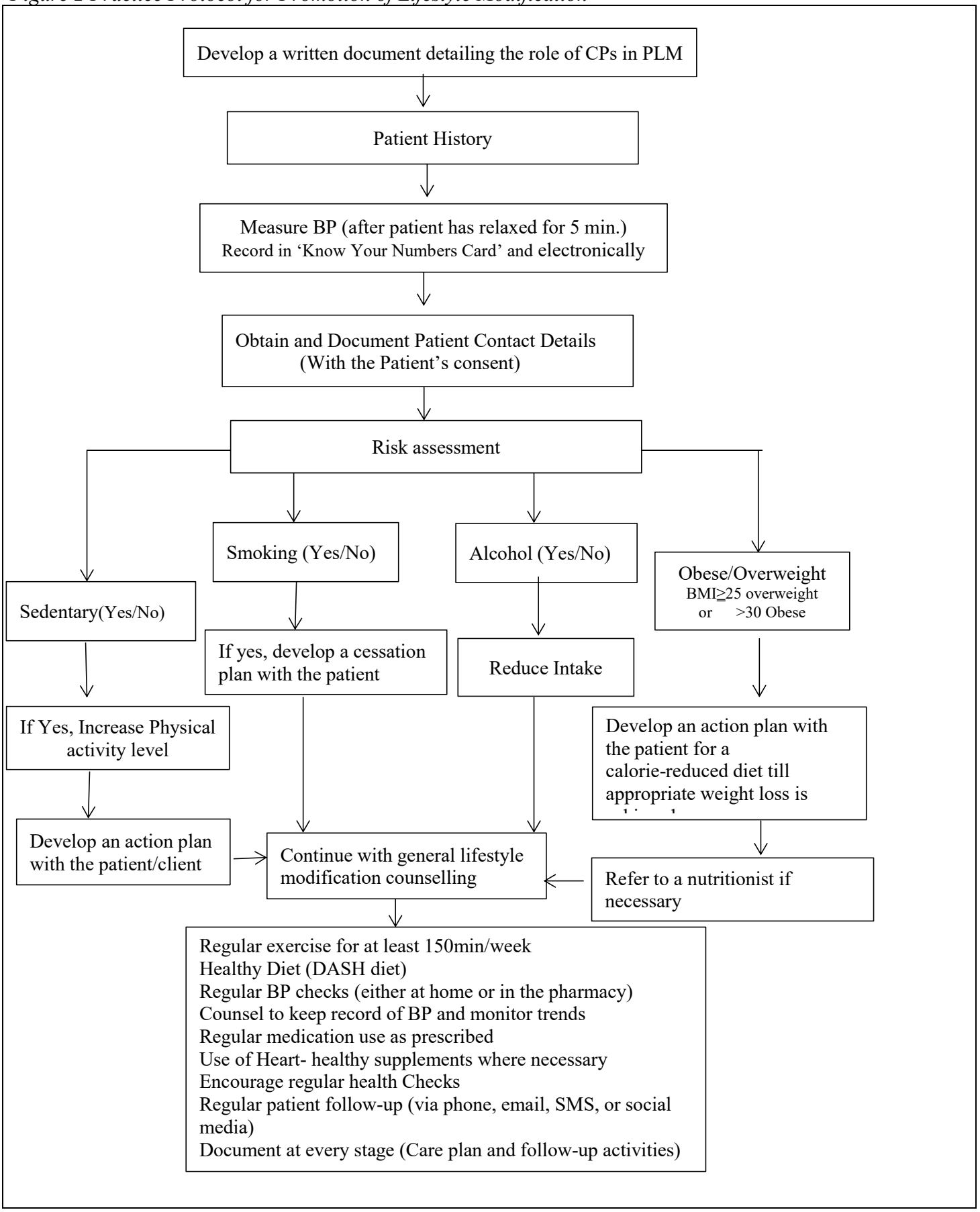


Table 2: Practical Knowledge of Promotion of Lifestyle Modification and Development of a Practice Protocol

Code Labels	Themes	Theme Clusters	Quotes
Confidence in teaching PLM	Self-efficacy	Self-efficacy	Absolutely confident. We have a training manual developed for new recruits. I tend to make them see the importance of gaining the client's interest (Participant #11)
Avenues for conducting health promotion and PLM	Media for conducting PLM: health talks, printed materials–flyers and bookmarkers, radio and TV jingles,	Enhancing effectiveness and reach for PLM	Promotional materials are given out on the World Health Days (Participant #3).
	Social media		We use social media to promote the campaigns, and the social media is a rich source of health information (Participant #3).
	Innovation and Value-adding service		For younger patients, we have a loyalty scheme, and they get reminders via email or SMS about time for refills (Participant #2).
Importance of Technology in PLM	Leveraging on technology		Technology is very useful for obtaining health information and makes documentation more effective (Participant #8 and #9)
Specific steps involved in PLM	Essence of a practice protocol	Community pharmacy protocol for PLM	Develop guiding framework or protocol. There should be uniform implementation of a standard practice protocol for pharmacies (Participant #1).
	Development of a practice protocol for PLM		

Note. PLM =promotion of lifestyle modification

Figure 2 Practice Protocol for Promotion of Lifestyle Modification



Discussion

PLM is a holistic, multidimensional phenomenon and the mainstay of preventive care in the management of HTN. Cognitive factors, pharmacy school training, agency (self-efficacy, strategies, and patient factors), and social structure (stakeholders and environmental factors) influence PLM from the perspectives of CPs studied.

Cognitive factors: CPs must have a good understanding of hypertension and the concept of PLM to counsel patients with HTN effectively. Constant knowledge and use of evidence-based strategies will enhance their practices. One of the participants explained that PLM entails,

"*Highlighting and creating awareness about a patient's role and the changes a patient needs to make to his daily life in order to have a positive impact on his BP and health".*

Some risk factors for hypertension mentioned in the study included lack of physical activity, obesity, stress, poor dietary choices. This is similar to findings from a study on nurses by Akinlua et al (2016). The approach of CPs towards PLM in hypertensive patients in this study focused essentially on individual patient counseling on regular BP and health checks, and patient-specific counseling on increased physical activity, DASH diet, smoking cessation, and reduction in alcohol intake. The seventh report of the Joint National Committee on prevention, detection, evaluation, and treatment of high BP (JNC 7) recommended the following lifestyle modifications in the management of hypertension – increasing exercise, adopting DASH eating plan, weight loss, reducing dietary sodium intake, and moderating alcohol intake (Challa et al., 2021). Some of the pharmacists interviewed in this study were not familiar with the term DASH diet. This points to a need for CPs to be trained on how to educate patients about DASH diet and factors influencing healthy food choices (Challa et al., 2021).

The CPs in this study counseled patients to exercise for at least 30 minutes three or four times in a week to maintain their heart health. Physical inactivity has been linked to 10% of all premature deaths and an estimated $117 billion in annual healthcare costs in the US (Giroir & Wright, 2018). Community pharmacists have an important role to play in highlighting challenges and dangers posed by uncontrolled hypertension including target organ damage, nephropathies and neuropathies and the need to increase their physical activity level.

Pharmacy School Training: Pharmacy education in Nigeria is undergoing a paradigm shift (Ikhile & Chijioke-Nwauche, 2016). However, there is still the need for updating the curriculum to make it more relevant. Participants also recommended that Doctor of Pharmacy should be the minimum entry qualification into pharmacy practice. This is a policy on paper in Nigeria, so the Pharmacists' Council of Nigeria and the National Universities Commission should ensure its implementation across all pharmacy schools in Nigeria in keeping with global standards.

Agency is about the capacity of individuals to act independently and make their own decisions. In this study the factors that pertained to agency of the CPs were self-efficacy, strategies, patient factors and other contextual factors including enablers and barriers to effective practice. To enhance their self-efficacy, CPs need to add some other skills to cognitive ability. Such skills include effective communication, presentation skills, persuasion, empathy, listening, counseling, and IT skills. The CP should speak the language the patient understands and be able to switch between dialects or from English to Pidgin English and communicate effectively even with illiterates using signs and symbols. Patient follow-up and appropriate documentation are essential aspects of the practice of PLM by CPs. The need to use appropriate software for documentation as cloud-based software was highlighted.

One-on-one counseling is a major strategy used for PLM and was termed as 'walk-in customer involvement' by one study participant. Healthcare professionals must be comfortable with counseling patients on PLM (Franklin, Myers, & Kokkinos, 2020). Social media and ICT are useful tools for extending access to counseling on lifestyle modification and other health issues. Other strategies being used by these CPs include online visibility (websites), integrative pharmacy practice and printed leaflets and flyers. It is recommended that CPs in Lagos should become more familiar with and use evidence-based strategies as motivational interviewing, lifestyle coaching, self-care management, concordance and the 5A's of behavior change communication in their practices (Franklin et al., 2020; Ikhile & Chijioke-Nwauche, 2016; Marfo & Owusu-Daaku, 2017).

Patient follow-up is a key enabler of the practice of

PLM, yet most of the CPs studied acknowledged their need for improvement in this aspect. An understanding of health behavior theories as the transtheoretical stages of change model (TTM) and their constructs may help to enhance counseling during patient follow up. The professional should identify the stage of change of the patient to be able to promote health behavior changes (Ikhile & Chijioke-Nwauche, 2016). TTM may help CPs to assess the motivational readiness of the patient to change his/her behavior (Glanz, Rimer, & Viswanath, 2015).). Patient follow-up is a mutually beneficial strategy to both the CP and the patient and so should be a priority for CPs in their practice. A good rapport between a patient and the CP is essential for good provider-patient relationship (Bajorek et al., 2017). CPs should therefore ensure professionalism and friendliness in their approach, and leverage on technology that can prompt them during the dispensing process to counsel on lifestyle modification (Alonso-Perales et al., 2017). It is important for CPs to document every aspect of patient encounters for lifestyle modification counseling either at initial visits or during follow-up visits as it provides a basis for monitoring trends in blood pressure and other parameters as the BMI and it serves as an evidence of practice and a measure of adherence to counsel given (Maes et al., 2017).

Barriers to practice pertained to the patient (financial constraints, attitude, ignorance, nonadherence to counsel, secretive behavior, belief systems), provider (time constraints, poor remuneration, poor cognitive and relationship skills) and organizational factors (lack of space for counseling and inadequate staffing). It has been recommended that CPs be offered some remuneration for additional pharmaceutical care such as lifestyle modification counseling (Marfo & Owusu-Daaku, 2017). A participant in this study suggested that monetary incentives be given to CPs as motivation to perform PLM. Other strategies for overcoming these barriers include improved practice relationship between doctors and CPs, better patient follow-up, more training, improved knowledge of integrative pharmacy, and the need to have dedicated pharmacist for PLM. A combination of behavioral and motivational strategies would help CPs to provide culturally sensitive health education to individuals with poor health literacy. CPs need to understand the contextual factors and use evidence-based strategies to contribute more to improving health outcomes in patients with HTN.

Social Structure involved stakeholders and environmental factors. The government, other healthcare professionals, churches, and nongovernment organizations were the stakeholders mentioned by CPs. Environmental factors also affect performance of PLM by CPs. An unfavorable practice environment occasioned by the lack of interprofessional cooperation between pharmacists and physicians has a negative impact on the practice of PLM by CPs. Poor perception of CPs by some doctors was highlighted by some of the participants in the study. In another study poor perception of other health professionals about the competencies of pharmacists was identified as a barrier to the utilization of public health services available in community pharmacies (Saramunee et al., 2017). Isetts et al. revealed from a study that interprofessional collaboration between pharmacists and physicians resulted in better patient outcomes and BP control in the management of hypertension and also led to reduced healthcare costs (Isetts et al., 2016). Networking and interprofessional collaboration are therefore recommended in the interest of the public and patients, and leaders of the various professional groups in the health sector in Eti-Osa LGA should cooperate to ensure better patient health outcomes.

Poor infrastructural development (lack of constant power supply and poor road networks leading to traffic jams in Lagos metropolis) were highlighted as a barrier to optimal practice in this study. A previous study highlighted that lack of social infrastructures hamper the utilization of health services (Chi et al., 2015). One implication of this is that CPs and all other stakeholders in health should step up advocacy to governments in Nigeria at the state and federal levels to provide adequate infrastructures for the citizens to contribute to improvement in quality of life of the people.

Practical knowledge of the practice of PLM by CPs was revealed through their self- report of self-efficacy, how their effectiveness can be enhanced, and this led to the development of a practice protocol shown in Fig 2. The CPs highlighted that they build self-efficacy in different ways including keeping abreast of current practices of PLM, maximizing knowledge, training interns and other colleagues, and attending relevant

conferences and training. Self-efficacy for PLM was assessed from steps taken for PLM highlighted by each CP and the specific counsels they would advise their colleagues to give to an adult patient with hypertension.

To enhance their effectiveness, CPs use various avenues to promote lifestyle modification in adults with hypertension. These avenues include health talks, printed materials –flyers and bookmarkers, radio and TV jingles, and social media. They use social media especially WhatsApp to promote the campaigns and pass across health information. The social media is a very useful tool for extending coverage for lifestyle modification counseling and follow-up. Social media channels have been used for successful health promotion interventions (Gabarron et al., 2018). Social media (including Facebook, WhatsApp, Twitter, and Instagram) provide avenues for efficient, user-friendly, and ubiquitous dissemination of health-promoting information and behavior change communication. These platforms encourage participation, engagement, and action in health promotion activities including lifestyle modification (Gabarron et al., 2018). Greater leverage on social media use is recommended to aid PLM in hypertension by CPs.

To build a successful community pharmacy practice, CPs must build and maintain lasting relationships with patients through the provision of quality value-added services. According to one participant, one way to add value is to "Preach wellness beyond prescription". This was explained to mean just giving needed counsel without selling any products when not necessary. Value- added services provided also include home visits to the elderly and free BP checks in some of the pharmacies while others have innovated a loyalty scheme targeting younger patients to encourage follow-up and reward their loyalty. The use of "know your numbers" cards for monitoring patient BP trends is another innovation by one of the CPs. The essence of leveraging on technology was highlighted by all participants to provide health information, aid adherence to counsel, ease documentation and as a tool for optimizing effectiveness. One participant said that technology can be used to motivate patients to action through visual images and gadgets may be used to send digital reminders to patients. All the participants in this study reported using telephones to contact patients or send health tips. mHealth and eHealth are two approaches to health by professionals leveraging on technology. eHealth involves the use of digital communications and information technologies to improve health and healthcare usually via the internet (Burke et al., 2015). mHealth on the other hand, involves the use of mobile communication or computing technologies as mobile phones and wearable devices to provide health information and services. Mobile devices aid self-management of chronic diseases and health promotion, and they facilitate exchange of health information between patients and healthcare providers. Therefore, the use of telephones and mobile applications by CPs in Eti-Osa local government area to send reminders and health tips to patients is an evidence-based approach to healthcare and should be encouraged as it can help to improve health outcomes through collaborative management between the patient and healthcare provider.

One previous study affirmed that guidelines and policies help to streamline services provided for hypertensive patients by CPs in developing countries like Ghana and Nigeria (Marfo & Owusu-Daaku, 2017). Specific steps highlighted by the CPs used for PLM have been used to design a guiding protocol. The steps were categorized according to four risk factors for hypertension – sedentariness, overweight/obese, smoking, or alcohol consumption (Figure 2). The steps involve documenting patient medication and medical history, BP measurement and documentation after allowing the patient to rest for 5min, risk assessment based on lifestyle, weight, smoking and alcohol status. This is followed by appropriate individualized counselling based on lifestyle and stage of change the individual is at. The specific counseling points are about regular exercise for at least 150min/week; healthy Diet (DASH diet); regular BP checks (either at home or in the pharmacy); keeping record of BP and monitoring trends; regular medication use as prescribed; use of heart- healthy supplements where necessary; encouraging regular health checks; regular patient follow-up (via phone, email, SMS or social media). Documentation at every stage of the care plan and follow-up activities is emphasized. The practice protocol developed will help CPs in Eti-Osa LGA to perform this role more effectively and to standardize practice.

This study confirms that community pharmacists contribute to improvement of public health by

promoting lifestyle modification in hypertensive adults in Lagos, Nigeria. This role can be enhanced by using a practice protocol. The practice protocol developed in this study would help CPs in Eti-Osa local government area to standardize and enhance their practice of PLM and improve self-efficacy.

Study Limitations

The CPs were not directly observed as they practiced PLM, but their expressed views were taken as actual practice of PLM. The researcher's knowledge of the phenomenon during interviewing may have introduced some bias but this was minimized by bracketing and reflective journaling.

Conflict of interest

The authors declare no conflict of interest with this research. No Financing was received associated with the article and related research.

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CASE STUDY

Internal Audit Process in eHealth: A Case-study

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ABSTRACT

Background

Internal audit operates within international professional practices established by the Institute of Internal Auditors (IIA). It contains an independent role from the organizational structure and represents the third line of defense in the implemented model of government, risk management, and internal control. Internal audit provides reasonable safety regarding the quality of the processes, including reporting to management about internal control and risk management.

Objective

Internal control processes and risk management in the scope of the processing of calls and the charging of the outsourcing company. Formulate recommendations for performance improvement in the ambit of health policies.

Methods

For its fulfilment, this work was based on international norms for professional practice in Internal Audit. The risk management methodology – COSO ERM (Enterprise Risk Management – Integrating with Strategy and Performance) and COSO (Internal Control – Integrated Framework) were also used for the analysis of internal control.

Results

There were identified two risks of operational nature and internal origin, two risks of a strategic nature related to the market, and three risks of a technological nature.

Conclusions

The recommendations described in the report are based on the relationship between public and health policies that have gained importance in recent years with the Covid-19 pandemic, since the beginning of 2020, accelerating the digital transition process in Portugal. Contributing to outstanding dissemination of Teleconsultations, technological development and privileging paperless recipes, meeting the guidelines for EU Digitization by 2030.

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What is already known on this topic?
The European Commission sees eHealth as a priority and encourages the creation of a global strategy in the countries of the European Union, with the objective of developing the transformation, the Telehealth Contact Center sorting system has been optimized with the introduction of Artificial Intelligence in the branching of the algorithms and in the conclusion diagnosis.

Main contribution to Evidence-Based Practice
In the current context, with the growing tendency to health digitalization and the market potential in telehealth, the role of internal audit has been gaining an indispensable position in the success of a company, fomenting quality and rigor in decision making. In this way, internal audit is capable of significatively contributing to risk reduction and the improvement of management quality, converting itself into lucrative processes for the company.

Implications for healthcare practice
The relation between the diagnosed risks and the improvement recommendations allowed the correlation of internal policies with public health which sustains the sector.

Authors Statement:
All authors contributed equally to the development and writing of the article

INTRODUCTION

Internal Audit operates within international professional practices established by the Institute of Internal Auditors (IIA) and inside the guidelines established by the regulatory authorities. It contains an independent function from the organizational structure and represents the third line of defence in the implemented model of government, risk management, and internal control. Internal Audit provides reasonable safety over the quality of processes, including the report to management on internal control and risk management and management declarations about the effectiveness of internal control (International Federation of Accountants, 2018).

The global digital health strategy from the World Health Organization for 2020–2025 points toward digital health which should be an integral part of health priorities and benefit the people in an ethical, safe, trustworthy, equitable, and sustainable way. Furthermore, it must be developed with principles of transparency, accessibility, replicability, interoperability, privacy, safety, and confidentiality.

Objectives of this paper: Evaluate internal control and risk management processes in the scope of the processing of calls and the charging of the outsourcing company; Formulate recommendations to improve performance in the sphere of health policies.
For this paper, the international norms for the professional practice of Internal Audit were used as a basis. The risk management methodology – COSO ERM (Enterprise Risk Management – Integrating with Strategy and Performance) and COSO (Internal Control – Integrated Framework) were also used for the analysis of internal control.

COSO ERM's implementation allows risk management to identify, manage and respond to risks effectively, since these risks cannot be eliminated, companies can implement COSO ERM as a strategic planning tool. (Ahmad et al., 2014; Society of Corporate Compliance and Ethics & Health Care Compliance Association, 2020).

The health sector is defined as a high-risk and high-complexity sector, with multiple interdependent dimensions (professional, technological, and organizational) which highlights the importance of risk management, even a low-risk event can have serious consequences that affect patients, staff, costs and the organization's reputation. (Kaya et al., 2019; Pascarella et al., 2021).

The COVID-19 pandemic has created for governments, managers, and professionals all over the world unprecedented challenges emphasizing the limitations of analogue health systems. As a response, several containment and mitigation strategies were implemented for common development observed during the pandemic restoring trust in digital health. (Niakan Kalhori et al., 2021; Petracca et al., 2020).

Telehealth emerges in Portugal as an innovative and sustainable solution that contributes to the strategy of digital transformation through the principle of approximation of the citizen to Health via the resolution of geographical inequalities, improvement in the health care accessibility, and the guarantee of a more sustained and articulated between the different levels of care, contributing to greater efficacy and efficiency of the National Health System. (Serviços Partilhados Do Ministério Da Saúde & Centro Nacional de TeleSaúde, 2019).

Telehealth should help innovate the models of care provided outside the institutions, and Innovation should help strengthen the utility of telehealth as a means of support to the health care provision.

The case study presented here focuses on the inherent results from the Internal Audit in the management of a telehealth private sector company to evaluate the impact of internal audit on decision-making. Moreover, this will aim to understand which are the central areas whose impact is notorious and representative, following the contact centre's management circuit, up until the department of quality and billing.
Due to their confidentiality, the auditing processes cannot be included in this study, likewise, the informative details about the company's characteristics cannot be shared.

Risk Assessment Framework

Risk management arises as a process through which organizations methodically analyse the risks inherent to the process, intending to attain a sustained advantage, both in each activity and in the set of all activities. (Kaya et al., 2019; Pascarella et al., 2021; Society of Corporate Compliance and Ethics & Health Care Compliance Association, 2020)

The choice of the COSO ERM model was due to its great adaptation to all the sectors of business activity, its stages being easy to work with and fit in the institutional reality. Besides being much more than a mere inventory of risks of a business, it is ample and includes administration practices which the administration utilizes for active risk management, going far beyond the Internal Control System.

The Telehealth Contact Center Company in analysis possesses a risk culture where it is ruled by conduct defined by a deontological code, and all sectors of activity are incentivized to report incidents to contribute to an improvement of the organizational systems.

Quarterly, the company reports its main risks (existing and emergent) to the risk committee, which could potentially compromise the reach of the strategic objectives of the company – Key Risk Reporting.

The event identification methodology of an organization can employs a combination of techniques as support tools. Accordingly, an analysis of the process referent to the call processing in eHealth was executed through the flow chart, norm verification, invoice verification, call monitoring and examination of the risk management prevention plan, so that all the gathered information allowed for the accomplishment of the following steps in risk evaluation.

According to the COSO ERM (2017) model, by identifying events, the administration considers a variety of both internal and external factors which may give rise to risks and opportunities in the context of the entire organization. After an analysis of those factors and utilizing the companies' objectives and auditing scope as a base – processing of eHealth calls, the following areas were identified as most susceptible to generating risks:

• **Human Resources Risk**	▪ Turnover
• **Operational Risk**	▪ Failure in the process of call typification
• **Market related Risk**	▪ Insurance Subscription ▪ Seasonality
• **Technological Risk**	▪ Information Security Risk ▪ IT systems instability Risk ▪ Internet related Risk

After the risk identification followed the evaluation in terms of probability of occurrence and impact, to determine how the risks should be managed.

For the qualitative evaluation of impact x probability and risks management map construction, the evaluation of probability is generally determined from past observable event data, which provide a more concrete base than entirely subjective estimates. However, the inexistant yielding of past events by the entity led to the necessity of a probability analysis with recourse to sensibility criteria.

In what concerns the impact evaluation, materiality criteria, image and criticality were considered as determinants of the eHealth contact centre companies' risk, each risk will be classified as low, medium, or high impact.

Each risk was then evaluated and portrayed in a risk matrix and was classified as high, moderate, or weak, the risk level was obtained for each event under analysis, thus being able to assess the priority of action by severity (Table 1).

After the risk analysis process, it was possible to ascertain measures, with the designation of those responsible, identify risks and prioritize action through preventive measures and mitigation mechanisms to manage risk, a graphical representation of identified risks was also elaborated, portrayed in Strategic Risk Map (Table 2).

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Risk Matrix									
Probability	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9
0,90									
0,80									
0,70									
0,60									
0,50									
0,40									
0,30							R2		
0,20						R6		R7 R1	
0,10		R5			R4	R3			
Impact	0,10	0,20	0,30	0,40	0,50	0,60	0,70	0,80	0,90

Table 1: Risk Matrix

Item	Category	Risk	Internal/ External Risk	Prob.	Impact	% Risk	Level	Response	Procedures to adopt which prevent its occurrence	Types of Control	Responsible
R1	Human Resources	Turnover Risk	Internal	High	Low	20%	Moderate	Mitigate	Provide improvement in the contractual conditions and the policy of incentives, to bind service providers to the company; Provide better work conditions;	PT	Nursing Direction; Human Resources Department
R2	Operational	Failure in the process of call typification	Internal	High	Low	25%	Moderate	Mitigate	Invest in formation sessions to improve background performance in service and coaching and leadership formation sessions for the supervision. Recruitment of differentiated nursing to the sector; Upgrade service software to make the call typification automated. ICS Improvement	PT/DT	Quality council; Clinical Direction
R3	Related to the Market	Insurance subscription risks	External	Moderate	Very Low	5%	Weak	Accept	Invest information sessions to improve service background performance; IT services reinforcement during promotional campaigns	PT	Clinical Direction and Quality Council
R4	Related to the Market	Seasonality	External	Moderate	Very Low	5%	Weak	Accept	Invest in formation sessions to improve background service performance.	PT	Clinical Direction and Quality Council
R5	Technological	Information Safety Risk	Internal	low	Very Low	5%	Weak	Accept	Perform frequent robustness tests to the system; Guarantee legal compliance referent to General Regulation on Data Protection.	DT/CT	IT Coordinator; Quality Council
R6	Technological	IT Systems instability Risk	Internal	Moderate	Low	20%	Weak	Accept	Solutions/Services responses adjusted to the market demands; Information systems upgrade; Evaluate market alternatives; Robust infrastructure, fast networks, and appropriate hardware	CT	Clinical Direction; Quality Council; Fiscal Council; IT Coordinator
R7	Technological	Internet Related Risk	External	High	Low	20%	Moderate	Mitigate	Network coverage investment and upgrade for extraordinary situations of call flows; Optimize the sound quality and mitigate call abandonment	PT/CT	Clinical Direction; IT Coordination; Fiscal Council

Methods

The referred paper methodology was based on international norms for Professional Practice in Internal Audit.

The institution in study belongs to the private sector of Telehealth, it possesses multiple services on the side of the Nursing Triage line, 24h/7 days a week, 365 days/year, with teleconsultations support through on-call or online specialist doctors, pioneers of algorithm integration in Health triage with recourse to artificial intelligence.

The private sector insurance company is international, being represented in Portugal through a Holding SGPS, SA. It is present in various business branches, these being banking, life insurance, non-life insurance and eHealth, this work was focused on the eHealth sector.

To proceed to the execution of audit procedures it was necessary to comprehend the functioning of the recourse to Artificial Intelligence and call management in telehealth.

Through the analysis of the process of call management with recourse to Artificial Intelligence (AI), the following typification of call variables were identified: Artificial Intelligence (AI), General Health Information (GHI), and Medication information services (MIS) (Table 3).

The established materiality for this process consists of the estimated total value of 34 650,00€ to the defined time frame (1º quarter of 2021).

Article Code	Category	Price		Nº Calls	Cost	VAT	Invoice Value
0001M	IA	1,00 €	0001M	27900	27 900,00 €		
0002M	GHI	0,75 €	0002M	7200	5 400,00 €		
0003M	MIS	0,50 €	0003M	2700	1 350,00 €		
					34 650,00 €	23%	7 969,50 €

A statistical sampling was chosen when considering the characteristics of the population where the sample was extracted. The use of a stratified sample was deemed more appropriate, since it was verified that dividing into distinct subpopulations with identified characteristics improves the efficiency of the audit, allowing for a smaller sample dimension without increasing audit risk (Table 4).

Statistical Method					
Stratified Sample	*p*=0,05		Confidence Interval 95%		
Call Typification					
IA	N=37.800	n=402			
GHI					
MIS	Checklist Compliance Test				
Invoicing					
IA	Estimated Value		Invoiced Amount		
GHI	34.650	2%	35.375		
MIS					
	Substantive Tests				

Table 3: Description of the statistical method

After collecting data in partnership with the financial and quality department, on average, 420 calls a day, and about 37 800 per quarter were verified, resulting in an N= 37 800.

A corrected sample was obtained with n= 402 where the n calculated for each stratum for call typification for the defined time frame should be audited – 1º quarter of 2021.

An analysis of billing in the defined time frame (1º quarter of 2021) was performed, resulting in the analysis of 3 invoices (1 monthly) selecting the defined sample for each call typology (Table 5).

	Monthly Invoicing	January		February		March		n
Typification of call		Calls Made	Number of calls	n	n	Number of calls	n	
IA Emergency		1680	560	4	500	3	620	5	12
IA Urgency		5220	1740	19	1740	16	1740	20	55
IA Telemedicine		10500	3400	39	3500	37	3600	40	116
IA visits		1800	600	7	500	5	700	7	19
IA Telecare		10000	3335	32	3325	32	3340	32	96
		29200							298
GHI		**7500**	2600	26	2300	24	2600	26	76
MIS		**1100**	**370**	10	360	8	370	10	28
		37800							402

Table 4: Billing analysis

Results

Activity and Internal Control

The Telehealth contact centre company interprets its control environment with a combination of the following factors:

- Management establishes conduct patterns and promotes risk and integrity culture through the fomentation of its deontological code.
- Management establishes structures, report lines, and responsibility levels to reach objectives.
- The allocation of internal control responsibility is applied in the whole organization.

The control activities are established through policies and procedures which help make sure guidelines given by management are executed. These helps guarantee that necessary actions are taken to confront risks in the achievement of company goals. (Richard M. Steinberg et al., 2007)

To get to know the Internal Control System objectives, the compliance with Internal control norm requisites of the Telehealth Contact Center Company, and the practices and proceedings of internal control inside the organization, it was necessary to elaborate a checklist of Internal Control.

The procedure for data collection was the elaboration of an internal control checklist, which consists of an investigation technique composed of several closed questions, with the goal of providing the auditor with a determined knowledge. (Schandl & Philip L. Foster, 2019)

The Internal Control System implemented in the Telehealth Contact Center Company, provides reasonable safety where the risks faced by its processes are under control. Albeit some improvement opportunities were identified and it is still possible to improve the efficiency of processes. Identifying specific controls which allow for more

precisely measuring the level of policy incorporation, regulations, and proceedings throughout the annual process of internal control evaluation.

Audit Test

The flowchart mapping was done to map the processes and identify the main steps and decisions in a workflow, with recourse to specific tools (map), where improvement opportunities may become evident through process analysis. To test the conformity of processing, we performed Compliance tests.

Once set the number of elements to analyze, the performance of the Compliance tests was put forward, with the selection of the totality of invoices (3) to the defined time frame and the analysis of the call typification process.

Thereafter, substantive tests were resorted to, which according to ISA 530 are audit proceedings designed to detect material distortions at the assertion level, which include detail tests and analytical substantive procedures. (International Federation of Accountants, 2018)

It was possible to verify that the deviation is in the sampling error interval defined for 5%, a deviation of ≈ 2% was detected, for a confidence interval defined for the audit sample at 95%, the risk of material distortion which remains after the execution of the procedure is low (725,00€).

An audit of the call monitoring quality report was made, corresponding to the quarter in analysis to the non-standard typification verification correlating it with the data from financial analysis.

Before the unconformities are detected and analyzed in quality, it is determined that it is congruent with the existing deviation in invoicing. The corresponding deviation is found, as aforementioned, inside the defined standard error value, in this manner, management accepts the risk and implements preventive and detective measures.

Quality Audit

The quality audit of the Telehealth Contact Center followed the norms established by NP EN ISO 9001:2015 (Inspecção Geral das Actividades Culturais, 2015), in which the Internal Audit Team, after analysis of the service at audit and after having set an area/scope of the process capable of audit and establishing objectives, execute the verification list suited to the proceedings and processes.

An observational method was used, a simple descriptive and sampling with Random Call Monitoring.

After the internal audit conducted on the Telehealth Contact Center, in the context of service and processing circuit of in-health contact centre calls, there were 6 unconformities observed out of which 2 correspond to a Human Resources nature risk; 2 to a risk nature Related to the Market; 1 with an Operational nature risk and 1 with a technological nature risk. (Table 2).

Internal Audit

The analysis carried out in the context of Internal Audit, presents as a result quality index is very satisfactory, without any critical risks; with a total of 6 unconformities, of which (1) in the category of human resources; (1) Operational; (1) Related to the Market; and (3) technological. With the necessity to implement preventive measures, for a moderate level of turnover risk (R1); preventive and detective measures for a moderate level of Failure in the process of call typification risk (R2); and implementation of preventive and corrective measures, for a moderate level of risk related to the internet (R7). It is proposed the implementation of preventive measures to the risks of Insurance Subscription (R3) and seasonality (R4); and detective and corrective measures for the risk of information security (R5), due to the low risk presented (Table 2).

Discussion

Quality Audit

In what confers to opportunities and improvement, 3 criteria were diagnosed with a level of moderate Human Resources and Technological risk. And one criterion to optimize with a low level of Operational risk. Hereupon, the Quality Audit Team recommends that the Telehealth Contact Center should as regards the Turnover Risk (R1) provide an improvement to the contractual conditions and the incentive policy to bind service providers to the company and invest in the

formation sessions to improve background performance in service.
Coaching, Leadership formation sessions for differentiated nursing to the sector supervision and recruitment. Improve labor conditions, optimize natural light sources, or in its impossibility, LED illumination.

Regarding the Risk related to the Internet (R7), investments should be made to upgrade the internet network for extraordinary situations of call flow (ex: Public Health; Natural Catastrophes, etc.), to optimize sound quality and mitigate call abandonment.

For these improvement propositions, it is also recommended the scheduling of a calibration session within the next 3 months, underlying the Failure in typification of calls process risk (R2), to align audit criteria regarding the monitoring of calls between internal auditors and supervisor nurses, so that the standard deviation between both is within the 5%, as predicted.

Internal Audit

When evaluating the Internal Control System and its consistency, it appears that in view of the non-compliance with the risk of failure in the call typification process and with regard to the risk related to the internet, where the risk level is moderate, management from the top, in view of the implemented preventive, detective and corrective tests, will analyze the recommendations of the internal auditors. An important goal of application control is to avoid the possibility of system errors, beyond detecting and correcting those that are present. (Nsw, 2019; Saigí-Rubió et al., 2022)

The consolidation of human resources is recommended, through incentive and continuous formation policies to prevent turnover, and improve the professional's performance, reflected in the Key Performance Indicators (KPI) and Telephone Service Factor (TSF).

Investment in software upgrades to automatize call typification, preventing human error; and improving client data protection with its encryption after two minutes of no utilization. Investment in network coverage upgrade for extraordinary call flow situations; and to the support call recorder for quality ends, which supports exceptional volumes of contacts.

The Telehealth Contact Center Company exhibits strong internal control measures, a risk culture instituted within its collaborators, and a deontological code and error situation report in its platform.

It is the responsibility of top management to consider the response, after the evaluation of the risk effect and the occurrence and impact probability. It is also the Administration that "identifies the opportunities which may exist and obtains, therefore, a vision of the risks throughout the organization or portfolio, determining whether the general residual risks are compatible with the appetite for risk of the organization" (Society of Corporate Compliance and Ethics & Health Care Compliance Association, 2020).

Strictly speaking, the responsibility for the risk does not belong to the auditor, but to management, it is up to them the decision of risk acceptance, avoidance, mitigation, or transfer to insurance companies or service providers. Therefore, the evaluation of possible answers to risk depends exclusively on the administration council.

Conclusion

In the current context, with the growing tendency to health digitalization and the market potential in telehealth, the role of internal audit has been gaining an indispensable position in the success of a company, fomenting quality and rigor in decision making. In this way, internal audit is capable of significatively contributing to risk reduction and the improvement of management quality, converting itself into lucrative processes for the company.

The described recommendations in the report are based on the relationship between public and health policies which have been gaining traction in the last few years with the Covid-19 pandemic, since the beginning of 2020 accelerating the process of digital transition in Portugal. Contributing to an exponent disclosure of teleconsultations, technological development, and privileging no paper revenues, going towards the UE orientations for Digitalization for 2030. Although the theme appears recent, the World Health Organization, since 2012 has developed

a manual on cybernetic health strategies and published the "Digital Health Strategies 2020-2025" in 2020. (Medical Association, 2022; World Health Organization, 2021a)

The general Health policies which benefit the company operating area of the Telehealth Contact Center are:

- Integration, continuity, and Health care proximity;
- Continuous commitment to innovation, investigation, and development to generate, test, and implement new ideas and solutions;
- Promote and publicize the eHealth concept amongst citizens and professionals and sensitize them to its benefits;
- Pressure on public policies as a stakeholder of the National Health Service or as an influence in benchmarking analysis;
- Transfer power and Independence to the client through the development of Artificial Intelligence technology by creating user-friendly technology;
- Innovation is an integral and transversal part of the Strategic Development lines in Telehealth, one new idea may add value;
- Dematerialization of processes as a benefit to Telehealth in the environmentally sustainable policy.

The relation between the diagnosed risks and the improvement recommendations allowed the correlation of internal policies with public health which sustains the sector.

Before the response measures analysis of the diagnosed risks in the report, the Administration Council needs to develop a plan of implementation that establishes control activities and cost-effectiveness responses directed to risk. (Society of Corporate Compliance and Ethics & Health Care Compliance Association, 2020; World Health Organization, 2021b)

This work focused on the importance of Internal Audit in an eHealth private sector company's management to evaluate the impact of internal audits in decision making and understand in which operational areas is the impact notorious and representative, following the contact centre's management circuit, up until the quality and billing department.

Limitations

This study permitted the application of the - COSO ERM (Enterprise Risk Management – Integrated Framework) risk management methodology in the eHealth sector highlighting the importance of cooperation between quality audit and internal audit in this sector of activity. However, this study describes our analysis based on the applied model, not possessing statistical relevance.

In future research, the impact of internal audit on corporate governance of Health organizations could be analyzed with a more representative and consistent data sample and in a broader study time frame.

Glossary

AC	Administrative Council
cT	Corrective Tests
DiT	Directive Tests
DT	Detective Tests
EU	União Europeia
GHI	General Health Information
IA	Inteligência Artificial
ICS	Internal Control System
IT	Information Technology
KPI	Key Performance Indicator
MIS	Medication information services
NHS	National Health Service
NP	Portuguese Standard
PT	Preventive Tests
TSF	Telefone Service Factor
WHO	World Healht Organization

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EXPERT COMMENTARY

Planning and Designing General Hospitals in Smart Technology Contexts

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ABSTRACT

Taking high-quality development of hospitals as the new era and the key health management direction, the paper draws lessons from advanced planning and design experience from an international perspective and discusses the construction of hospitals to be compliant, orderly, efficient and focusing on providing high quality care. The article formulates an overall strategy for the planning and development of the hospitals keeping in mind the whole life cycle based on current technological trends, practical, forward-looking and developmental space, as well as promote the organic integration of high-quality care and hospital buildings with the surrounding environment, so as to drive an overall coordinated development of the region where hospitals are located.

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What do we already know about this topic?
By the end of the 20th century, hospital design and planning gradually evolved into an efficient approach that uses biological and clinical perspectives to understand life and emphasize the dynamic balance of health and disease. After entering the 21st century, with the introduction of the concept of the impact of comprehensive environment and impacts on physiological, and social factors on human health and disease, the concept of ecological hospital has been gradually established.
What is the main contribution to Evidence-Based Practice from this article?
The article contributes to the international debate on Planning Smart Hospitals and related healthcare management challenges. Hospital Managers around the World get a fresh perspective on Planning and Design smart hospitals.
What are your research's implications towards theory, practice, or policy?
The planning and design of large general hospitals should undergo systematic changes in the new period. The trend of hospital design in the future

Author' Contributions Statement:
Muqing Niu conceptualized and wrote the whole article.

INTRODUCTION

Large general hospitals in the new era Hospital is an overall concept [Qi, 2016]. It is an innovative, coordinated, green and intelligent hospital in line with the basic medical system of socialism with Chinese characteristics under the background of the new era, "Healthy China 2030", post-epidemic, new infrastructure and informatization and digitalization [Wang, 2008; Chen et al, 2022]. It covers the site, construction, construction equipment and medical equipment, hardware and software support system, operation, and maintenance management, etc. (Zhao & Niu, 2022)

1 Future-oriented hospital planning model for the new era

The transformation process of hospital design concept: in the middle of the 20th century, was mainly a traditional hospital with scattered machinery, which mainly emphasized the function of medical treatment, ignored human emotion, and took the disease as the foundation. By the end of the 20th century, it gradually developed into an efficient hospital that uses biological and medical perspectives to understand life and emphasizes the dynamic balance of health and disease. After entering the 21st century, with the introduction of the concept of the impact of comprehensive environment on physiological, and social factors on human health and disease, the concept of ecological hospital has been gradually established.

The planning mode of hospitals in the new period can be divided into four forms [Liu, 2018;]: centralized, decentralized, centralized, and decentralized comprehensive, and centralized+ modular unit.

Centralized+ unit modularization means that the units of various medical departments are modularized, and the departments of medical technology and service support are intensified and arranged in the core position of the hospital. By means of three-dimensional transportation organization [Ren, 2020], the unit modules of medical departments are connected with them. The form should be a radial, combined ring layout around the medical technology services and other departments, or a grid layout. At the same time, it is necessary to provide extended and expanded channels for the future development of the hospital.

For the urban center area with limited land use, centralized planning mode should be adopted. Outpatient departments, medical technology, hospitalization, and logistics should be concentrated in one building. Related medical functions should be arranged around the functional core and transportation center. The problem of resource sharing among outpatient, inpatient and medical

technology departments should be solved well. When the site is extremely tight or the hospital building is directly adjacent to the city road, the first floor can be raised to extend the entrance square to the inside of the building, to form a good transition between the hospital and the city.

The construction plan should be in accordance with a planning, overall construction, or phased construction, reserved for development space. Near-and long-term comprehensive consideration, and mainly in the near future. On the premise of first meeting the recent basic requirements, attention should be paid to the growth and evolution of hospital space, and strive to achieve a plan, phased implementation.

2 Planning ideas for hospitals in the new era facing urban space

The location of the main entrance of the hospital is coordinated with the urban spatial planning [Zhao Jie et al]. The location of the entrance and exit should avoid the urban main road, overpass, expressway, and other roads with heavy traffic flow, and choose to arrange the entrance and exit on the urban secondary road with larger planning width.

The location of the main entrance of the hospital is as close as possible to the subway station, bus station and other public transport service facilities, which increases the dependence of hospital visitors on public transport, thus reducing the traffic flow and parking pressure of the hospital.

The planning of hospital parking facilities, people flow, and traffic flow should be coordinated with the surrounding traffic outside the hospital and the medium- and long-term development planning of urban space.

3 Main ideas of hospital planning and design in the new era

3.1 Transportation organization in the hospital

Rationally set the direction and location of the entrance and exit of hospital projects [Zheng Jie, 2020]. Make full use of underground space, reasonable organization of traffic. Can use the pedestrian ground, car underground transportation mode. The garage entrance and exit are set close to the entrance and exit of the courtyard to reduce vehicles' walking through the courtyard. Ground vehicles should not exceed 20%. Emergency vehicle parking space should be provided at the entrance to emergency first aid.

Hospital circulation can be divided into three kinds of circulation, namely decontamination flow, doctor-patient flow and person-vehicle flow, and cross infection should be avoided. The partitions and medical rooms of the hospital should be equipped with obvious guiding signs to facilitate the quick diversion and evacuation of personnel. An entrance square should be set up at the outpatient, emergency, and inpatient entrances as a buffer area for the admission of people. The planning of the streamline in the hospital should be for the purpose of realizing the integration of medical construction and clear technology, establishing multi-dimensional landscape and transportation organization, healing environment of ecology, science and education and humanity, and efficient, complete, and plastic medical space.

3.2 Vertical design of the site

The design elevation of the site shall not be lower than the level of the city's designed flood control and waterlogging. The site can adopt flat slope type, step type, mixed type. When the natural terrain slope is less than 5%, it is appropriate to choose the flat slope; When the natural terrain slope is greater than 8%, it is appropriate to use the stepped type, and the platform joint should be set up retaining wall or slope protection. Important medical technology Settings and service support facilities should be planned as far as possible above the water level of the city's designed flood control and waterlogging, such as nuclear magnetic, transformer and distribution rooms. If it is necessary to plan under the water level of the city designed for flood control and waterlogging prevention, special measures and plans must be taken to prevent flooding accidents.

Each unit module under the framework of general plan planning: the process design of main departments, namely the secondary process design [Li Guoxin, 2015; Lloyd Wiliams, 2022], is mainly to solve the relationship between each functional plate and each department. The three-level process design should solve the specific use process of departments and functional plates and rooms, including the main medical room design, at this time to coordinate with the structure, mechanical and electrical, plumbing professional, consider the factors of mutual constraints, to adjust the local room, these start from the preliminary design, continue to the construction

drawing design stage, constantly adjust and optimize. The deepening design of medical special, including purification engineering, protection engineering, logistics system and other professional design should be carried out simultaneously.

3.3 Planning of building location

The planning of building location [Hu, 2015] should pay attention to the good orientation of main buildings, and the spacing of buildings should meet the requirements of health, sunshine, fire protection, lighting, ventilation and so on. The inpatient department should have good sunshine conditions and landscape vision, and the spacing between the front and back of the ward buildings should meet the requirements of sunshine and sanitary spacing and should not be less than 12m. Natural lighting and ventilation should be considered as far as possible in outpatient areas. When the morgue is set up independently, there should be enough space between it and the ward, kitchen, and canteen. The residential area adjacent to the hospital must be separated and equipped with a separate entrance and exit. The infectious diseases department building, and fever clinic were located downwind, which had the least impact on the hospital. The distance between the infected building and surrounding buildings was not less than 20m. It should be close to the emergency department and take into account the collaborative management of emergency. During the epidemic, it can operate independently and form its own zone in strict accordance with the design of "three zones and two channels". Reserve land for expansion nearby and expand the emergency treatment ward when the epidemic occurs to meet the needs of treatment; Sewage from infected buildings is treated separately and discharged to the hospital sewage treatment station.

In the new era of "post-epidemic", attention should be paid to the "combination of epidemic response" [Wei Yanyong et al], and the general adjustment of epidemic and non-epidemic situations should be taken into account in the planning and design. First of all, in terms of regional division design, the hospital in non-epidemic period is divided into general treatment area, infectious disease treatment area and administrative office area. In epidemic period, the hospital should conveniently combine the general treatment area and infectious disease treatment area into the closed isolation area for infectious disease treatment. It is convenient to construct makeshift hospitals or administrative closed isolation areas in some administrative office areas. At the same time, both epidemic and non-epidemic situations should be considered in terms of functional streamline and isolation measures.

3.4 Planning of building green space

Make full use of terrain, protective spacing and other open space to arrange green space, and there should be special green space for patients ' rehabilitation activities. Hospitals in the new era require to return to nature, emphasize people-oriented, create green environment, and form the concept of sustainable development. For patients suffering from pain, they need a good environment to help treatment and rehabilitation. The design takes the design of green environment as a key point and takes the concept of green ecological garden-style hospital as the leading role to carry out the green landscape design of the hospital area [Zhang Zhiqian, 2022]. The planning of the courtyard should be more for the consideration of the patients, the location should extend to the depth as far as possible, close to the patients and their accompanying families, and the visualized green square in front of the hospital should not be made, which is the essence of the return of landscaping to comfort the soul.

3.5 Medical process design

Medical process design [Li Huiyu, 2021] should determine the structure, function and scale of medical business, as well as related medical processes, infection prevention and control requirements, medical equipment, technical conditions and parameters. The building design shall be carried out after the approval of the user department. The key medical process shall meet the specific requirements of the local medical audit department. The large general hospital in the new period should focus on the first-level technological process of hospital construction and give proper consideration to the reasonable planning of the second-level process. All departments should not only meet the current demand for medical technology equipment, but also reserve space for the upgrading of medical technology equipment in the future.

The main entrance and exit of the single building must

have a parking area for motor vehicles, and the pedestrian ramps should be designed as barrier-free ramps. More than half of the wards should get good sunshine and landscape. In accordance with the relevant regulations of local planning and health authorities. Large medical equipment should be located on the ground floor or outdoors, and departments with more inspection frequency should be located on the lower level. Rationally allocate the number of beds in inpatient nursing units. Do doctors and patients partition shunt, do not interfere with each other.

4 Architectural design and interior design

The architectural design of the hospital should be incorporated into the overall image design of the urban space. The concept of urban design should also be introduced into the overall exterior image design. The characteristics of the surrounding urban environment should be fully analyzed, the favorable environment, space and other elements should be made good use of, the spatial streamline should be set reasonably, the beautiful urban contour should be enriched, and the architecture should be integrated into the urban environment.

The new and old buildings should have a dialogue with each other, with both contrast and coordination. It not only shows the image of a new modern hospital, but also reflects the heavy disciplinary history of the hospital.

The historical context of the city should be respected to reflect cultural confidence [Cui Jianfeng et al]. For example, the requirements for architectural style and regional planning control of a city in central China are shown in
Table 1.

Table 1. Related requirements of architectural style and regional planning control

Area and position	Specific historical features and coordination areas		Modern new Tang style area		Modern style
Roof form	Ming and Qing dynasty style (hard gable roof)	Su Yuan style (simplified red machine tile slope top)	Sui and Tang style (full slope roof)	There are no restrictions on the roof of the building, but it should be changed	There are no restrictions on the roof of the building
Wall façade	Pay attention to the form and proportion of the window, pay attention to the lighting and ventilation area	"Three-stage" separation, appropriately matched in brick red	Pay attention to the form and proportion of the window, and decorate the Tang style element symbols in appropriate positions	The façade reflects proportion and rhythm through the form of windows	The wall is made of modern styling elements to reflect the sense of the times
Building base layer	The base layer of the building can be combined with the site, and wall skirts can be set up	Properly refine the detailed elements of Luoyang architecture during the Suyuan period	The base layer of the building can be combined with the site, and the base can be set up, and the separation	The base layer of the building can be combined with the site, and wall skirts can be set up	The base layer of the building can use gray space and combine functions to make shape changes

The minimum indoor clear height is 2.60m in the examination room, 2.80m in the ward and 2.80m in the medical technology department, or as required. Public walkway 2.30m. The permissible noise level of the ward shall meet the relevant requirements. It is advisable to choose standardized main structural components, and modular and assembled enclosure materials. The selection of building materials and structural design should meet the requirements of scrubbing resistance, corrosion prevention, leakage prevention and easy cleaning and maintenance.

5 Planning a smart hospital

The connotation of smart hospital should include: to provide warm and comfortable medical treatment and working environment. Reduce energy consumption, green, energy saving, environmental protection. Facilitate medical treatment, improve the response speed and service level of medical services. Improve clinical work efficiency and medical quality. Reduce management personnel, reduce management costs,

improve management level. To achieve safe, reliable, efficient and stable operation of the hospital.

The design of smart hospital is mainly realized by using computer, communication, network, informatization, digitization, automatic control, big data, A and I, logistics network and other advanced technological means. Intelligent system of intelligent hospital has the characteristics of multiple subsystems, complex structure, high requirements, high technical difficulty, strong function and extensive involvement.

The future development direction of smart hospital [CAI, 2023;] will be based on the efficient integration of BIM, 5G, data center, industrial Internet, Internet of things, cloud computing, artificial intelligence and other high-tech technologies. Therefore, hospital design based on BIM+ big data + cloud platform combined with evidence-based design theory will be one of the main methods of hospital design in the future.

In the Outline of the Healthy China 2030 Plan, it is required to build an integrated medical and health service system with complete systems, clear division of labor, complementary functions, close cooperation and efficient operation. Basic medical and health resources within counties and cities should be rationally distributed according to the resident population and service radius to ensure equal access to basic medical and health services for all. At the provincial level and above, regional medical resources should be allocated in a coordinated way, regional medical resources should be integrated and shared, and high-quality medical and health resources should be allocated evenly, so that everyone in the province can enjoy uniform diagnosis and treatment of critical and difficult diseases and specialized medical services. It has established a three-in-one mechanism for the prevention and control of major diseases involving specialized public health institutions, general and specialized hospitals, and community-level medical and health institutions, established an information sharing and interconnection mechanism, and promoted the integrated development of chronic disease prevention, treatment, and management, so as to realize the integration of medical treatment and prevention. In order to achieve the above goals, the planning and design of smart hospital will become an important carrier to realize the Planning Outline.

BIM and other advanced engineering management technologies are integrated into the whole process of hospital planning, design, construction and handover, and the hospital construction has been promoted with high efficiency and precision. After the handover, BIM technology is used to realize the digital operation and maintenance management of the whole life cycle of the hospital [Zhao Haipeng, 2022].

6 Conclusion

Through the above-described elaboration of the planning and design concept of large general hospitals in the new period, from the perspective of the development of hospital planning and design, the planning and design of large general hospitals should undergo systematic changes in the new period. A key trend in hospital design in the future may also follow Professor Badenin's claim that the hospital will be a whole integrating the truth of science, the goodness of humanity and the beauty of art.

To sum up, taking human needs as the core, operation as the leading, integrating culture, science and technology, art and design wisdom, to design an intelligent and optimized complex, which will be the trend of planning and design of large general hospitals in the new era.

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CASE STUDY

Hospital intelligent medical waste construction based on wireless IOT with Bluetooth + LoRa: a Case Study

Zhiyuan Zhao[1], Muqing Niu[1]

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ABSTRACT

With the maturity of the Internet of Things technology, medical institutions have established a positioning and sensing wireless IoT platform for the entire medical institution by using technologies such as Bluetooth positioning beacons, LoRa communication base stations, positioning and map engines. The intelligent medical waste collection and transfer vehicle integrates the wireless Internet of Things platform in the hospital based on 4G/5G modules, Bluetooth positioning terminals, electronic weighing and other technologies. An information-based, intelligent, and visualized "smart medical waste" management system covering all aspects of medical waste generation, collection, temporary storage, transfer, and disposal has been established in medical institutions. This set of solutions can greatly reduce the number of communication base stations deployed in hospital indoor buildings, the number of weak current construction and access switches in hospitals, save a lot of unnecessary costs for weak current construction and access switches and meet the real-time needs of intelligent medical waste collection and transfer vehicles such as real-time positioning, real-time tracking, video linkage, trajectory playback, and transfer route deviation alarms, which have certain reference significance in the practice of intelligent medical waste construction technology in hospitals based on smart IoT.
The article describes one case of implementation of the technology in a university Hospital.

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What do we already know about this topic?

With the maturity of the Internet of Things technology, medical institutions have established a positioning and sensing wireless IoT platform for the entire medical institution by using technologies such as Bluetooth positioning beacons, LoRa communication base stations, positioning and map engines

What is the main contribution to Evidence-Based Practice from this article?

The article demonstrates how a intelligent medical waste collection and transfer vehicle integrates the wireless Internet of Things platform in the hospital based on 4G/5G modules, Bluetooth positioning terminals, electronic weighing and other technologies. An information-based, intelligent, and visualized "smart medical waste" management system covering all aspects of medical waste generation, collection, temporary storage, transfer, and disposal has been established in medical institutions

What are your research's implications towards theory, practice, or policy?

This set of solutions can greatly reduce the number of communication base stations deployed in hospital indoor buildings, the number of weak current construction and access switches in hospitals, save a lot of unnecessary costs for weak current construction and access switches and meet the real-time needs of intelligent medical waste collection and transfer vehicles such as real-time positioning, real-time tracking, video linkage, trajectory playback, and transfer route deviation alarms, which have certain reference significance in the practice of intelligent medical waste construction technology in hospitals based on smart IoT

At present, most medical institutions in China mainly adopt the traditional medical waste management model. These medical institutions use manual registration books for recording and handover throughout the process. At the same time, the property logistics personnel responsible for the transfer and handover of medical waste are generally of low professional quality and weak sense of responsibility. There are many problems, such as not following the prescribed route, and the loss of medical waste. The management of medical waste in medical institutions has become more difficult. At the beginning of 2020, ten departments in China, such as the National Health Commission and the Ministry of Ecology and Environment, jointly issued the "Notice on Printing and Distributing the Work Plan for Comprehensive Waste Management in Medical Institutions".

The plan clearly states that "through standardized classification and clear procedures, a waste management system of classified delivery, classified collection, classified storage, classified handover, and classified transfer will be formed in each medical institution. The disposal of medical waste is tracked and managed in a refined way, making full use of electronic tags, two-dimensional codes and other information technology methods to ensure that the wastes of medical institutions should be divided and traceable. " According to national requirements, in the past two years, some provinces have launched a battle to speed up smart medical waste. It requires pilot hospitals to take the lead and lead the area from point to point to realize the full coverage of information-based dynamic online supervision of the whole process of medical waste generation, transfer, temporary storage and handover, and realize a new closed-loop management model of traceability, traceability and early warning of medical waste. Therefore, higher requirements are put forward for the construction of medical waste informatization in medical institutions.

1. Technology selection and construction ideas

1.1 Technology selection

At present, the commonly used wireless IoT technologies include LoRa, Bluetooth, active RFID, passive RFID, WIFI and so on. Different IoT technologies have different applicable scenarios and apply different IoT technologies. Various work

scenarios in the hospital cannot be realized and completed using a certain Internet of Things technology. A medical IoT application can use one or more IoT technologies to achieve good results and experiences for the medical IoT application. After comprehensive comparison, Bluetooth Beacon positioning + LoRa low-power long-distance wireless transmission technology not only supports data transmission of positioning terminals, but also supports data transmission of sensing terminals, according to the characteristics of hospital medical waste business. Its positioning accuracy reaches 1-5 meters, and it can realize intra-hospital navigation through positioning and map engines. Moreover, the deployment of Bluetooth beacons and LoRa base stations has the advantages of low implementation cost, no need for a large number of wired deployments, little impact on hospital operations, and low cost of operation, maintenance and management in the later stage.

Based on the above technical features and advantages, it is recommended that medical institutions use Bluetooth + LoRa wireless positioning technology to establish a wireless Internet of Things platform for hospitals (see table 1 below).

1.2 Construction plan

Medical institutions should use Bluetooth positioning technology combined with the application of low-power and long-distance LoRa transmission technology, and adopt a converged, open, and wireless deployment strategy to build an efficient, high-precision, low-investment, and low-maintenance smart IoT platform. Bluetooth positioning terminals and sensing terminals should be installed on intelligent medical waste collection and transfer vehicles with functions such as electronic weighing, automatic counting, face recognition cameras, and QR code scanning. A four-in-one hospital intelligent medical waste management system, including smart IoT platform, smart medical waste vehicle, in-hospital monitoring, and medical waste management system, should be established through indoor positioning network, sensor network, wireless intranet, and in-hospital monitoring, etc.

The main technical architecture of the smart IoT platform is simple and highly scalable. It consists of iBeacon Bluetooth positioning beacon, Bluetooth positioning terminal, LoRa communication base station, positioning and map engine, deployment inspection + POI information management and calibration App, mobile app, server software, etc. The LoRa communication base station and the intelligent IoT platform software server equipment are directly connected to the POE communication switch through the network cable. The data interaction of the application platform is completed through the POE communication switch. In the whole system, only the LoRa communication base station requires a very small amount of wiring, and the rest of the equipment can work as long as it is connected to the power supply, so the implementation degree of medical institution transformation is small.

1.3 Implementation method

The iBeacon Bluetooth beacon positioning node should be deployed in the indoor pipe gallery. It can emit Bluetooth signals as a positioning infrastructure network infrastructure. The intelligent medical waste collection and transfer vehicle is equipped with a Bluetooth positioning terminal tag. It receives iBeacon signals and communicates the signal measurement results with the LoRa communication base station through proprietary technology to transmit data back. The LoRa communication base station receives the data returned by the Bluetooth terminal tag, and sends the data back to the positioning and map engine server. By calculating the coordinate position of the Bluetooth terminal tag, it provides indoor map information, and provides services such as route inspection and indoor navigation for the intelligent medical waste collection and transfer vehicle.

2. Effects observed

The intelligent medical waste collection and transfer vehicle realizes the visual management and control of medical waste vehicles and terminal equipment by connecting to the intelligent IoT platform in the hospital. Its advantages are mainly reflected in the following four aspects:

2.1 Real-time positioning

The Bluetooth beacon of the medical waste collection and transfer vehicle has a real-time positioning function, so the real-time location of all medical waste collection and transfer vehicles can be visualized on the PDA and indoor electronic map. The real-time location of all medical waste collection and transfer vehicles can be known and queried at any time. If the transfer route of the medical waste collection and transfer vehicle deviates, the medical waste supervisor can receive the notification at the first time, so as to realize the real-time positioning monitoring of the medical waste collection and transfer vehicle.

2.2 Real-time tracking and video linkage

By connecting with the internal monitoring system of the medical institution, if necessary, the designated medical waste collection and transfer vehicle can be tracked in real time. The indoor electronic map will be identified and displayed with highlighted colors. Therefore, when it is necessary to view the real-time image of the nearest camera of the designated medical waste collection and transfer vehicle, the staff can link the camera to transmit the camera image closest to the designated location to the indoor electronic map interface in real time, which can satisfy the medical institution's video monitoring of the status of the medical waste collection and transfer vehicle, and also meet the unannounced inspection needs of the government supervision department.

2.3 Track playback

Through the real-time data returned to the positioning and map engine, it is possible to play back the trajectory of the indoor electronic map for the designated medical waste garbage and the area where the transfer route passes and stays in a certain time period of a certain day. It can accurately restore the previous transfer route, residence time, etc., and help the medical waste management personnel to quickly analyze whether the medical waste is not in accordance with the specified transfer route during the collection and transfer process through the track playback function, resulting in the leakage of medical waste.

2.4 Transit route deviation warning

A message reminder mechanism is established. When the collection and transfer vehicle does not follow the prescribed route sequence or deviates significantly from the prescribed route to transport medical waste, the medical waste management personnel will be reminded in time according to the set alarm rules. The alarming function of the deviation of the transfer route is convenient for tracking the status and quantity changes of medical waste, dynamically monitoring the outflow of various links in the hospital, identifying problems and tracing the source in time, effectively controlling the illegal outflow of medical waste, and filling the supervision gap of in-hospital transfer and temporary storage points.

3 Conclusion

Through the establishment of advanced hospital smart Internet of Things, the use of artificial intelligence, cloud computing, big data and other advanced information technologies, combined with the medical waste disposal process of medical institutions, medical institutions have realized the information and intelligent management of medical waste circulation. This means that each bag of waste and medical waste collection and transfer vehicle can have its own unique identification code, the process of waste from generation to disposal is transparent and standardized, all data can be recorded and uploaded in real time. Therefore, medical waste can be intelligently collected, transported and disposed of, classified from the source, and its supervision process can be standardized to establish a traceable and accountable closed loop of medical waste supervision. Especially in the current background of strict prevention and control of new coronary pneumonia, the establishment of the hospital smart Internet of Things can significantly improve the level of refined management of medical waste in medical institutions, achieve comprehensive safety management and control of medical waste, and

make positive contributions to joint prevention and control (see table 1 below)

Table 1 Comparison of Bluetooth + LoRa and commonly used active RFID

Indicator item	Bluetooth + LoRa	Active RFID
Project implementation costs (labor, network cables, access switches, etc.)	very low	very high
Does device deployment require a large number of external network cables?	very little	numerous
Does the device deployment require a large number of wired deployments?	none	numerous
Weak current construction	Very little network POE power supply and network communication	Requires a lot of weak current construction
Impact of construction on hospital operations	Wireless construction and no impact on hospital operations, basically	The antenna needs to be deployed in the ward, which has an impact on the structure of the ward and the operation of the hospital
The amount and difficulty of post-maintenance work	Small workload, basically wireless deployment, easy maintenance	Heavy workload, basically wired deployment, difficult maintenance
precision	1-3m (indoor) 3-5m (outdoor)	Interval level (five to ten of meters)
Geofencing functionality	High accuracy and high availability	Poor accuracy, difficult to use
Indoor navigation function	support	not support

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