Scientific and Social Research

Editors-in-Chief

Dr. Vahid Kouhdaragh

Lancaster University, UK

Assoc. Prof. Dr. Fei Liu

Sichuan University of Science & Engineering, China

BIO-BYWORD SCIENTIFIC PUBLISHING PTY LTD
(619 649 400)
Level 10
50 Clarence Street
SYDNEY NSW 2000
Copyright © 2023. Bio-Byword Scientific Publishing Pty Ltd.



Scientific and Social Research

Focus and Scope

Scientific and Social Research publishes papers devoted to quantitative social science research and methodology. The journal features articles that illustrate the use of quantitative methods to empirically test social science theory. The journal emphasizes research concerned with issues or methods that cut across traditional disciplinary lines. Special attention is given to methods that have been used by only one particular social science discipline, but that may have application to a broader range of areas with an ultimate goal of testing social science theory.

All relevant papers are carefully considered, vetted by a distinguished team of international experts, and rapidly published. Original articles, short communications, case studies and comprehensive review articles can be submitted online via the journal's submission and peer review site.

About Publisher

Starting 2022, *Scientific and Social Research* is published by Bio-Byword Scientific Publishing, which is a fast growing peer-reviewed and open access journal publisher located in Sydney, Australia. As a dependable and credible corporation, it promotes and serves a broad range of subject areas for the benefit of humanity. By informing and educating a global community of scholars, practitioners, researchers and students, it endeavors to be the world's leading independent academic and professional publisher. To realize it, it keeps creative and innovative to meet the range of the authors' needs and publish the best of their work.

All Bio-Byword Scientific Publishing journals are free from all access barriers, allowing for the widest possible global dissemination of their manuscripts and highest possible citations. Online submissions made to Bio-Byword Scientific Publishing journals will go through a rapid peer review and production, making the process of publishing simpler and more efficient, which benefit from its user friendly online submission system that reduces the overall time from submission to publication.

Publisher Headquarter

BIO-BYWORD SCIENTIFIC PUBLISHING PTYLTD
Level 10
50 Clarence Street
Sydney NSW 2000
Website: www.bbwpublisher.com
Email: info@bbwpublisher.com

October 2023, Volume 5, Issue 10

Table of Contents

1 **The Primary Health Care Services in a Philippine Province**
Leo f. Malinay

50 **Intelligent Transportation Planning and Construction in the Era of Big Data**
Can Chen

56 **Strategies of Integrating of Physical Education and Academics**
Qi He

62 **Artificial Intelligence and IET: Subversion, Supervision, and Reconstruction**
Di'ao Xie

73 **Analysis of Berth Allocation Problems of Mainline and Feeder Vessels due to Ship Delays**
Baowei He

78 **From a Sacred Space to an "Exhibition Platform": The Changes in the Nature of Modern Genealogy**
Meijie Xie

87 **Research on the Application of Big Data in Retirement Service Management**
Xiao Huang, Yi Zhuang, Xiuyu Hu, Gang Yu

91 **Popularizing Science Among the Grassroots: Development, Existing Problems, and Countermeasures**
Na Shen, Xiaodong Duan, Yindi Yao

Scientific and Social Research, 2023, Volume 5, Issue 10
https://ojs.bbwpublisher.com/index.php/SSR

The Primary Health Care Services in a Philippine Province

Leo f. Malinay*

The Graduate School, Lyceum of the Philippines University, Batangas 4200, Philippines

***Corresponding author:** Leo f. Malinay, lheifmalinay@gmail.com

Copyright: © 2023 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

Abstract: The study aimed to assess the effectiveness of primary health care (PHC) in selected municipalities in Batangas, focusing on various health programs. It involved 384 respondents from different municipalities. The questionnaire was the primary data collection instrument, validated by experts and based on national health programs provided by the Department of Health. The findings revealed that the majority of respondents were females aged 40 to 50, with a high school education, and primarily from Barangay Buli, Taal, Batangas. The effectiveness of PHC services varied across different health programs. Programs like maternal and child health, Expanded Program on Immunization, tuberculosis control, and dental health were considered effective. However, diarrheal disease and STD/AIDS prevention programs were rated less effective. Significant differences were observed when assessing the effectiveness of PHC services based on respondent profiles. Respondents aged 51 and above had a more positive view of PHC effectiveness, except for the Diarrheal Disease program. Females generally perceived PHC services as more effective than males, except for specific programs. Educational attainment also influenced the perceptions of effectiveness. Recommendations included requesting increased budget allocation, building facilities, and using social media for awareness campaigns to improve PHC services. The proposed action plan was suggested for future implementation and evaluation. Future research should explore the delivery of PHC services using different variables, specifically focusing on service delivery in PHC.

Keywords: Primary health care; Health programs; Effectiveness; Survey method

Online publication: October 20, 2023

1. Introduction

Primary Health Care (PHC) is defined by the World Health Organization [1] as a "whole-of-society approach to health that aims at ensuring the highest possible level of health and well-being and their equitable distribution by focusing on people's needs and as early as possible along the continuum from health promotion and disease prevention to treatment, rehabilitation and palliative care, and as close as feasible to people's everyday environment."

PHC addresses the comprehensive determinants of health and concentrates on the wide-ranging and interconnected aspects of physical, mental and social health and wellbeing. It affords whole-person care for health needs throughout the lifespan, not only for a set of specific diseases. PHC guarantees people will receive

excellent comprehensive care, starting from promotion and prevention to treatment, rehabilitation and palliative care, as close as possible to people's everyday situation [1].

Formulating the application approach of the PHC has spelled significant adjustments and conformance in the governance of health development, encouraging the partnership of government with various segments of civil society such as nongovernment organizations (NGOs) and people's organizations (POs) among others. It likewise enabled other sectors to take an active role in responding to the health requirements of the community. Secondly, it emphasized the involvement of various programmatic areas to ensure effective management of health, weaving health into socio-economic development, making for an integrated perspective. Thirdly, it advocated prioritizing promotive and preventive aspects of health, rather than investing resources mainly on curative care. Thus, as early as 1978, there was a convergent effort to give priority attention to the eight essential elements of health care: education on prevailing health problems and the methods of preventing and controlling them, promotion of adequate food supply and proper nutrition, basic sanitation and promotion of an adequate supply of safe water, maternal and child care (including family planning), immunization against the major infectious diseases, prevention and control of locally endemic diseases, appropriate treatment of common diseases and injuries, and provision of essential drugs [2]. The demographics of each country is different, with different age groups distribution, risk factors, and economic and epidemiological contexts. This makes it difficult to establish a general PHC system that suits all countries [3].

In the Philippines, the topic of health has become increasingly more important over the past few decades in the Philippines. Health is a basic human right guaranteed by the Philippine Constitution of 1987, provided in the Philippines through a dual health delivery system composed of the public sector and the private sector. The public sector is largely financed through a tax-based budgeting system, where health services are delivered by government facilities under the national and local governments.

The local government in the Philippines consists of 81 provinces, 145 cities (of which 33 are highly urbanized cities and five are independent component cities), 1,489 municipalities, and 42,025 barangays [4]. With the devolution of health services under the Local Government Code of 1991, the direct provision and management of health services such as public health programs, promotive and preventive health care, and primary and secondary general hospital services were transferred to the Local Government Units (LGUs). Under the set-up, the provincial government, headed by the governor, manages the provincial health system; the municipal government, headed by the mayor, manages the municipal health system (composed of Rural Health Units [RHUs] and Barangay Health Stations [BHSs]); the city government, specifically in highly urbanized and independent cities, manages city hospitals, medical centers, health centers, and BHSs.

In every province, city, or municipality, a local health board has been set up and chaired by a local chief executive. Its function is to serve as an advisory body to the local chief executive and the local legislative council (*sanggunian*) on health-related matters. Under the Local Government Code of 1991, the Department of Health (DOH) maintains representation in all local health boards with the help of DOH representatives.

The current physical infrastructure of the Philippine health sector is composed of (1,224) hospitals, (2,587) city/rural health centers and 20, 216 village health stations [5].

The Province of Batangas aims to promote the well-being of Batanguenos through the leadership of Gov. Hermilando I. Mandanas. Health topped the priority programs of the provincial government, which increased its budget share to PhP 697 million, from the previous PhP 616 million, to cover, among others, the hiring of permanent health personnel and the increase in of compensation/honorarium of volunteer health workers. The system for medical services, particularly on indigent patients, has been streamlined; a stronger Philhealth program is presently being implemented; and the Provincial Health Card System, which will be provided to

volunteer workers to augment Philhealth benefits and to be honored in all 12 provincial district hospitals, will soon take effect. Just recently, a consignment system in the procurement of medicines by all the district hospitals had been institutionalized through a Sangguniang Panlalawigan Ordinance to ensure the supply of medicines and supplies at the lowest cost [6]. In additional to district hospitals, rural health units have also been equipped and enhanced to offer the devolved programs from the DOH.

The RHUs serve as the main source of free basic healthcare for rural communities around Batangas City. Thence, clinics with at least one doctor including adequate nurses and volunteer workers have the sole responsibility of looking after a community of thousands of people whilst at the same time having only a limited number of resources at their disposal. As such, the quality of primary health services remains elusive or inaccessible to majority of the population, especially those living in the rural and poverty-stricken areas of the province [7].

The COVID-19 pandemic that commenced in rural China has had considerable impact on the country's implementation of the PHC. Practitioners took on substantial additional workload as part of epidemic control and fewer patients were administered under the PHC system. Practitioners reported a major shift in their work away from seeing and treating patients to exclusive COVID-19 clinics to focus on the key public health roles of tracing, screening, and educating in rural areas. The additional work, risk, and pecuniary pressure confronted by PHC practitioners parturiated considerable strain and anxiety on the medics particularly those assigned in village clinics. Face to face PHC provision was surpassingly reduced as there was no consultation available either by phone or access through online medical apps, which practitioners attributed to the fact that most of their patients were elderly and not willing or able to switch. Practitioners saw COVID-19 as outside of their area of expertise and very different to the non-COVID-19 respiratory tract infections that they frequently treated pre-pandemic [8].

This study was conducted with the aim of contributing to the enhancement of the primary health care services provided in the RHUs of the whole province of Batangas. The study took off by first determining the effectiveness of the primary health care services provided by the rural health units as perceived by the residents of the sampled municipalities and based on the findings, recommend an action plan that may be used as inputs in policy formulation focused on the provision of better health care services in the province. This study also intended to provide valuable inputs that may be used by the DOH in assessing the level of effectiveness of ongoing health care services.

Subjectively, the researcher, being a Doctor of Public Administration student, has long envisioned his proclivity to contribute by and large to the enhancement of the status of primary health care services. He plans to use the knowledge he has accumulated in the degree program to contribute to the body of knowledge related to PHC. However, there is a dearth in local literature focused in the PHC services that may be used as foundations or inputs to help enmasse the effectiveness of primary health care services.

Furthermore, as a former Board Member of the Province of Batangas and currently presiding the Sangguniang Bayan of Lian, Batangas, the researcher has long envisioned to formulate policies or ordinances aimed at the betterment of the primary health care services. During the conduct of his duties, he has personally observed how dependent the marginalized communities are to rural health units. In addition, the onset of COVID-19 has created a health pandemic that has affected the RHUs. As such, he came up with this study to determine the effectiveness of primary health care services offered in selected municipalities of the province of Batangas and come up with salient suggestions in an action plan containing details and the overall blueprint on how to enhance it.

2. Objectives of the study

This study generally aimed at determining the effectiveness of the primary health care in selected municipalities in the province of Batangas.

Specifically, it aimed to determine the profile of the respondents in terms of age, sex, educational attainment, and number of times primary health care was availed of in the municipality; to assess the effectiveness of primary health care services offered in the municipality with regard to maternal and child health program, Expanded Program on Immunization (EPI), tuberculosis control program, nutrition program, control of acute respiratory infection, environmental sanitation, diarrheal disease program, cardiovascular disease and control program, dental health program, reproductive health and family planning program, voluntary blood donation program, rabies control program, STD/AIDS prevention program, cancer prevention and control program, leprosy control program, and health education and circumcision program; to test the significant difference in the effectiveness of primary health care services when grouped according to profile variables; and to propose an action plan to enhance the effectiveness of primary health care services in the province of Batangas.

3. Literature review

3.1. Research locale

To be able to determine the effectiveness of the primary health care services, the study focused on third to fifth class municipalities. From these municipalities, the barangays with the highest population were chosen as the participants of the study.

Batangas became the first practically organized province in Luzon and was officially founded in the year 1581. Balayan was the capital of the province for 135 years from 1597–1732. In 1732, it was moved to Taal, the most progressive and flourishing town of the province then. After several calamitous eruptions of Taal Volcano that buried then old Taal town site, the capital was transferred to Batangas in 1754, where it has remained as such to the present.

The province is bounded on the north by the province of Cavite; on the northeast and east by the province of Laguna and Quezon, respectively; and on the south by Verde Island passages and on the west by the China Sea. It has a land area of 316,581 hectares or 3,165.81 km^2. It is comprised of 31 municipalities and 1,078 barangays. To date, it has been further divided into 6 congressional districts.

The Provincial Health Office of Batangas sets its goal of uplifting the health of the people particularly Batanguenos through promotive, curative, preventive, and rehabilitative aspect of health care delivery. Its mission to develop health conscious and healthy families and communities through partnership with the people by the provision of the four ACES: availability, accessibility, affordability, acceptability and omnipotently guided health care services and a vision of a socialized medicine for the Batanguenos especially the underprivileged sector of the community. At present, there are 12 government hospitals by district.

For the first district, Matabungkay in Lian, Buli in Taal, and Luntal in Tuy served as the research locales.

Matabungkay is a coastal barangay in the municipality of Lian, in the First District of the Province of Batangas. It has a population of 5,398 as determined by the 2020 Census, which represented 9.59% of the total population of the Municipality of Lian [9].

Matabungkay has a household population of 4,918, which can be broken down into 1,119 households or an average of 4.39 members per household [4]. The population of Matabungkay grew from 2,136 in 1990 to 5,398 in 2020, an increase of 3,262 people over the course of 30 years. The latest census figures in 2020 denote a positive growth rate of 1.89%, or an increase of 460 people, from the previous population of 4,938 in 2015.

Matabungkay is led by Barangay Captain Ernie Cabahog. They have an existing BHS manned by barangay health workers (BHWs), Barangay Nutrition Scholars (BNS) and under the supervision of a midwife directly reporting to the Municipal Health Officer.

The second research locale was Buli in Taal, Batangas, which is one of the oldest towns in Batangas. The buri plant, which was said to be prospering in that region long before the arrival of the Spaniards, gave rise to the name Buli. The plant buri, also known as "*buli*" in the Batangas dialect, is used to produce mats, hats, fans, and sweet sap from its leaves [10].

Buli's population in 2020 was 5,703, with a growth rate of 7.57%. That year saw an increase of 1,670 compared to the previous population of 4,033 in 2015 [11]. Buli, under the leadership of Hon. Edwin Semaña, has the highest internal revenue allotment (IRA) amongst barangays in Taal, Batangas.

The third research locale was Tuy, Batangas. When Tuy gained independence, Don Salvador Elio (of Spanish descent) was the one who gave the name of the municipality, to honor his hometown in Spain. Tuy became an independent town on August 12, 1866. The municipality is under the supervision of Hon. Jose Jecerell Cerrado. Tuy consists of 13 barrios, including Luntal. In 2015, the population of Luntal rose to 3,066 with a total of 715 households. Based on the 2020 Census, Luntal gained a growth rate of 3.58% that is equivalent to an increase of 558 people. Luntal is under the leadership of Hon. Oliver M. Andaya and is one of the richest barangays in Tuy, Batangas, having two daycare centers, a newly built barangay hall, and a covered court [12].

For the second district, the research locales were Dulungan in San Luis and Balibago in Lobo, Batangas.

The fourth research locale was San Luis. San Luis was part of the municipality of Taal. San Luis was already a town in 1861, but because of its small income, it became part of Taal again in 1904, and it was renamed as Balibago during the Spanish time. On the 2nd of February, 1918, San Luis became a municipality for the second time. No record was found on how the municipality got its name [13]. San Luis earned national fame when it was awarded "Top Performing Local Government Unit" and "Top Performing Local Executive" in 2018 for successfully implementing health programs, which in turn made San Luis receive the highest scores in health critical indicators for local government units. In identifying the winners, the DOH looked at the LGUs' implementation of health programs such as immunization for children, tuberculosis cure rate, and facility-based delivery within the year [14].

Dulungan is one of the 26 barangays of San Luis. Its population, based on the 2020 Census is 3,095. The household population of Dulungan in 2015 was 2,868 with 689 households, or an average of 4.16 members per household. Dulungan started with a population of 1,884 in 1990. It had 330 households and its average household size was 5.71 members per household [15]. According to barangay officials, the name of the barangay was derived from a fish species called "*dulong*" which thrived in the coastal waters of the barangay.

The fifth research locale was Balibago, in the Municipality Lobo. Its land area is 12,247,410 hectares, its barangay classification is agricultural, rural, and coastal. Balibago began with a population of 1,959, and it accounted for 5.43% of the households Lobo. Balibago's population was 3,454 in 2015, which consisted of 716 households that held 4.82% of the average household size. In 2020, its population rose to 3,491 [16]. Balibago is under the governance of Hon. Nestor Camo.

Seven municipalities from the third district were included in the study as research locales. These municipalities ranged from third to fifth class municipalities.

Coral na Munti is located in the northeastern part of the Municipality of Agoncillo. This barangay consists of four sitios, namely: Maligaya, Bilog-Bilog, Bagong Pook, and Mabini. The name Coral na Munti came from a story of a messenger who made an effort to spread the barrio leader's news. When he reached the land of the unknown place, he tried to find someone, but there was no one in the town. Instead, he found a ballpen that had

the word “Coral na Munti” engraved on it. Starting that day, the town was called Coral na Munti [17].

The barangay had a population of 3,793 population, with 792 households, and an average size of 4.79 members per household in 2015. Based on the 2020 Census, Coral na Munti has a total population of 4,347, which represents 11.27% of the total population of Agoncillo [18]. Coral na Munti’s chairperson is Hon. Rizalino H. Vergara.

Alitagtag is a landlocked municipality. It has a land area of 24.76 km^2, or 9.56 square miles, which covers 0.79% of the whole Batangas area [19]. Alitagtag is derived from the word “Alinagnag,” which means “a small district of light.”

Alitagtag used to be a barangay in Lumang Bauang (Bauan), its terrain is covered with big and hard trees and thick vegetation. The municipality gained its independence in 1908. It is subdivided into 19 barangays, and among them is Poblacion West.

Poblacion West’s population in reached 2,445 in 2015, including 520 households, with an average of 4.70 members per household. In 2020, it had a population of 2,595, showing a growth rate of 1.26% since 2015, which is equivalent to an increase of 150 people [19].

Balete was a former barangay of Lipa City, the old generations said that during their days, where there were less residents, balete trees were abundant. As time passed, the place became known as Balete. The municipality was liberated from Lipa City on June 21, 1969 as the Congress of the Philippines enacted the Republic Act No. 5659 [20].

There are 13 barangays in the Municipality of Balete. Among these are Barangay Malabanan. Its population as determined by the 2020 Census was 5,049 [21]. This represented 20.99% of the total population of Balete. It is broken down into 940 households, with an average of 4.93 members per household [22].

Cuenca is a fourth-class municipality in the third district of Batangas. It became a municipality on November 7, 1876. The municipality was named by Governor Paez to give respect to his hometown in Spain because it resembles the place’s climate and green scenery. As of today, Cuenca has 21 subdivided barangays, and that includes Dita [23].

Dita’s population grew from 2,342 in 1990 to 4,655 in 2020, an increase of 2,313 people over the course of 30 years. The latest census figures in 2020 denote a positive growth rate of 0.35%, or an increase of 76 people, from the previous population of 4,579 in 2015 [23].

Mataas na Kahoy is a fourth-class municipality in the third district of Batangas under the leadership of Hon. Janet M. Ilagan [24]. Mataas Na Kahoy was established as a municipality on January 2nd, 1932. This town is a small piece of land that has 2,376 hectares and it is subdivided into 16 barangays [24].

District III is located in the Municipality of Mataas na Kahoy. The population in District III was 3,385 in 2020, and it showed an increase of 1,994 people over the course of 30 years. Besides, the city’s population grew by 1.47% or 227 people, from the previous population of 3,158 in 2015 [25].

San Nicolas is considered as the smallest and the fifth municipality in Batangas. It was formerly part of Taal and only became independent in the year 1995 [26]. The name “San Nicolas” was derived from the name of the town’s patron saint, San Nicolas de Tolentino [26].

Poblacion is a barangay in the Municipality of San Nicolas. It has a total population of 3,178. This represented 13.29% of the total population of San Nicolas [27]. Poblacion has no BHS at the present. The BHWs use barangay halls for their medical activities.

Sta. Teresita is a fifth-class municipality in the Third District of Batangas. It was declared as a town on December 26th, 1961 and is politically subdivided into 17 barangays.

Among the barangays in Sta. Teresita, Barangay Calayaan has the highest population. In 2020, the

population grew to 2,320, which represented 10.76% of the total population of Santa Teresita [28].

3.2. Components of PHC services based on Alma Ata 1978

PHC was first conceptualized by the World Health Organization in the 1970s to determine the social causes of poor health, such as poverty and lack of access to proper healthcare [29]. This led to the issuance of the Alma Ata Declaration during an international conference in Russia in 1978. This move defined the global priorities to attain health for all in the year 2000 and subscribed to the PHC approach as key to attaining this goal [30]. It further considered primary health care as the means to maintain better health standards for all people by the year 2000. According to this Declaration, "primary health care is essential health care based on practical, scientifically sound, and socially acceptable methods and technology" [31]. Hence, health care proponent proclaimed that PHC is the first contact of individuals with the country's health system [32]. Thus, it can be defined as the corner stone for national health. It has been reported that the cost-efficiency of health care would be better by transitioning the focus towards primary health care [33].

In addition, the Alma-Ata made the following declaration: "Health is a fundamental human right and that the attainment of the highest possible level of health is a most important worldwide social goal, the existing gross inequality in the health status of the people particularly between developed and developing countries is politically, socially, and economically unacceptable; economic and social development, based on a new international economic order is of basic importance to the fullest attainment of health for all; people have the right and duty to participate individually and collectively in the planning and implementation of their health care; governments are responsible for the health of their people, which can be fulfilled only by the provision of adequate health and social measures; all government should formulate national policies, strategies, and plans of action to launch and sustain primary health care; all countries should cooperate in a spirit of partnership and service to ensure PHC for all people; and an acceptable level of health for all the people of the world by the year 2000 can be attained through a further and better use of the world's resources" [34].

The past 40 years saw PHC provisions moved from thoughts and words to action and reality and is still crucial in current global health context [35], especially for developing countries [36]. The United Nations (UN) announced eight Millennium Development Goals (MDGs) in 2015 [37]. However, the achievements were unsatisfactory, and thus, the UN announced 17 Sustainable Development Goals (SDGs) and expected them to be achieved in 2030 [38]. These 17 goals should be taken seriously and actively implemented by all countries. Health and wellbeing are among the SDGs and PHC is one way to achieve that goal. More specifically, Gillam stated that Alma-Ata Declaration is still relevant for effective healthcare systems, since the core principles of PHC are keys to moving towards health equity or universal health coverage under such a changing and challenging context [39]. In the World Health Report of 2008, WHO Director General Margaret Chan addressed that PHC deserved the greatest attention for policy makers and national governments [35]. Health systems which are oriented towards PHC are more likely to have better health outcomes and greater public satisfaction at lower costs and true access [40]. PHC has usually been regarded as the initial point of contact for individuals wishing to access health care [34], especially for the vulnerable groups [39].

The Philippines adopted the PHC strategy following the 1979 Alma Ata Declaration. The country already had a long history of PHC and community health programs as part of rural development programs and reforms in restructuring the health care delivery system. The 1991 Local Government Code devolved the health sector to the Local Government Units. In 2013, the DOH, the Philippine Health Insurance Corporation, and the Department of Science and Technology started the implementation of the Philippine eHealth Strategic Framework and Program which set the direction for the adoption of eHealth solutions to health care service

standards and services including that for natural and man-made disasters. These legislatives and program initiatives on health influenced the PHC implementation in the Philippines, hence the need to review the status of PHC in the country. The eight essential elements of PHC effectively integrates the health and social development aspects of the health system: (i) safe water and sanitation, (ii) food and nutrition, (iii) maternal and child health, (iv) immunization, (v) curative care, (vi) essential drugs, (vii) health education, (viii) traditional medicine, and (ix) community development. In spite of the integrating PHC framework and elements, the physical, social, and environmental vulnerabilities of the country as a whole have led to disruptions in the health systems' development [41].

3.2.1. Environmental sanitation

The world is worryingly off-track in the delivery of sanitation for all by 2030. Inopportunely, the Philippines is on the same path. At the recent rate of global progress, the aim of safely-managed sanitation for everyone will not be a reality until the twenty-second century.

Almost 50.3 million Filipinos or 10 million families presently do not have access to safely-managed sanitation services, and of these, some 24 million use limited and/or unimproved toilets or none at all. Safely-managed sanitation means the use of improved toilet facilities which are not shared with other households and where the excreta are safely disposed on-site, or are transported and treated off-site [42].

Environmental risk factors such as air, water, and soil pollution, chemical exposures, climate change, and ultraviolet radiation contribute to more than 100 diseases and injuries worldwide. In 2012, an estimated 12.6 million people died as a result of living or working in an unhealthy environment, that is nearly 1 in 4 global deaths. The Philippines is not spared from this burden with environmental risk factors contributing to at least 22% of the reported disease cases and nearly 6% of reported deaths in 2006.

The Philippines experiences a "triple burden" of disease, this refers to the high incidences of key communicable diseases, the rising rates of non-communicable diseases, while also being one of the highest disaster-prone countries in the world. These environmental risk factors are part and parcel of this triple burden of disease. To address this, the WHO Country Office in the Philippines is supporting the DOH's environmental health programs and most recently on its National Environmental Health Action Plan [43].

"Implementing the SDG on sanitation is an investment, but inaction brings us even greater costs. Untreated waste from poor sanitation services has negative effects on the environment and can spread diseases that cause poor health and nutrition, loss of income, decreased productivity, and missed educational opportunities," said Dr. Rabindra Abeyasinghe, the WHO representative of the Philippines [42].

To achieve the national targets of universal access to environmental sanitation, an average investment of PhP 30 billion per year is needed [44]. This is 13% of the additional internal revenue allotment that local government units will receive by 2022, valued at PhP 225.3 billion per year [45].

3.2.2. Safe water and sanitation

The Declaration of Alma-Ata proclaimed PHC, along with water, sanitation, and hygiene (WASH), to be basic inputs for public health. More recently, the UN SDGs highlighted universal health coverage and access to safely managed water and sanitation services as key pillars of human security [46].

Safe drinking water and sanitation are fundamental to the people's living standards. The improved standards made possible by WASH (water, sanitation and hygiene) include, among others, better physical health, protection of the environment, better educational outcomes, convenience, assurance of lives lived with dignity, and equal treatment for both men and women. Poor and vulnerable populations have lower access

to improved WASH services and have poorer associated behaviors. Improved WASH is therefore central to reducing poverty, promoting equality, and supporting socioeconomic development [47].

In the Philippines, unsafe and contaminated drinking water is the primary cause of high incidence of waterborne diseases, specifically cholera, diarrhea, and typhoid. Hence, the Water Safety Program aims to provide safe and accessible drinking water for the public. The quality of drinking water must always be within the criteria set by the Philippine National Standards for Drinking Water to ensure that it is safe for human consumption. Within this program, water quality surveillance initiatives are also established to guarantee the operations and compliance of all drinking water service providers.

3.2.3. Food and nutrition

The essential role of primary health care to improved nutrition was explicitly drawn in the Alma-Ata Declaration of 1978 [48]. Halfdan Mahler, the then Director-General of the WHO and a key architect of the Alma-Ata Declaration, in a speech in 1982, contended that primary health care advances nutrition when countries have (i) explicit nutritional objectives, (ii) sustained and adequate levels of nutritional care components, (iii) integrated monitoring and evaluation mechanisms for nutrition-related outcomes, and (iv) community involvement [49]. Furthermore, he highlighted the role of health professionals in encouraging intersectoral policy-making and intersectoral action for health and nutrition [50].

In the Philippines, malnutrition remains to be a public health concern. Among the common nutritional deficiencies are Vitamin A, iron and iodine. The goal of the government, through the DOH is to improve quality of life of Filipinos through better nutrition, improved health and increased productivity. The developed programs and projects to achieve these are food fortification, micronutrient supplementation, nutrition information, communication and education, home, school, and food assistance, and community food production.

Food fortification is an important element of the Philippine Plan for Action on Nutrition. Several programs are designated for the fortification of frequently consumed food, including but not limited to salt, sugar, rice, wheat flour, oil and margarine, and foods with essential micronutrients, especially vitamin A, iodine and iron, to make up for dietary gaps for these nutrients. The overall program is designed to be spearheaded and implemented by the food industry, whereas the government is to deliver necessary support through policies, technology development and transfer, and incentives to inspire the participation of food manufacturers. The main goal of the government's Sangkap Pinoy Seal Program is to encourage the manufacture of high-quality fortified food products. The seal is awarded to manufacturers who meet standards for fortifying products with vitamin A, iodine or iron. The seal promotes general public awareness of the availability of fortified foods with guarantee of quality and, thus, encourages consumption of fortified food products [50].

Micronutrient supplementation is one of the interventions to address the health and nutritional need of infants and children and improve their growth and survival. Distribution of Vitamin A capsules conducted twice-a-year through the "Araw ng Sangkap Pinoy" (ASAP), known as Garantisadong Pambata or Child Health Week is the method adopted to provide micronutrient supplements to 6–71 months old preschoolers countrywide [51].

The Provincial Government of Laguna is home Nutrition Honor Awardees (NHA) in the country, with the Municipality of Kalayaan, in Calamba, bagging the top award. This activity is included in the mobilization of local government units which is among the strategies under the Philippine Plan of Action for Nutrition 2017–2022 [52]. This aims to contribute to the enhanced improvement of the local nutrition state through effective nutrition program management. Through this activity, local government units are given opportunity to expand their perspectives on opportunities of nutrition action at the provincial, city, municipal and barangay level.

Laguna PNAO Teresita S. Ramos outlined the nutrition projects and activities like supplementary feeding,

integrated community food production, nutrition education, resource generation, advocacies, and capacity building while CNAO Aleli Catalina Jimenez of Calamba City emphasized that mobilizing the city nutrition committee and Barangay Nutrition Scholars as partners is one of the keys to effective nutrition program management. Through this endeavor, Calamba City won the Nutrition Honor Award for its outstanding nutrition programs. At the barangay level, Punong Barangay Sally M. Dela Cruz of Barangay Pansol also explained that the cooperation and involvement of the community, particularly the parents or mothers helps in better delivery of health and nutrition services.

In the Municipality of Kalayaan, Mayor and Chair of the Municipal Nutrition Committee Leni M. Adao who was previously a Municipal Nutrition Action Officer also shared the municipality's nutrition strategies. One of its banner programs is food production in partnership with municipal agriculture office and health office. Some of the programs implemented are as follows: container gardening, Halamanan sa Bakuran, Paaralan at Barangay, malunggay tree planting in schools, barangays, and households, production of malunggay leaves capsules for pregnant and lactating women, and organic livestock raising. The municipality focused on its vast agricultural lands for food security. Besides, one unique feature of the municipality is the pool of women as department heads, which may have been a principal factor in the enhancement of nutrition advocacy in the area. She said that to make every endeavor successful, it takes motherly love, passion, honesty, integrity, and service above oneself. The LGU of Kalayaan is one of the municipalities in Laguna with outstanding implementation of nutrition programs.

Areas in Region I and the Province of Laguna also have similar nutrition programs implemented. The only difference, which poses a challenge to all nutrition workers, is the difficulty of institutionalizing, converging and sustaining nutrition-related programs. An important learning was that nutrition advocacy is a continuous process considering that the right to nutrition is mandated in the Philippine Constitution. Nutrition as a multi-faceted issue needs support from the different partner agencies especially for allocating funds. Therefore, the budget for nutrition-related activities to each agency during planning stage of the LGU should be practiced [52].

3.2.4. Maternal and child health

Maternal and child health (MCH) care is the health service provided to mothers (women in their child bearing age) and children. The targets for MCH are all women in their reproductive age groups, i.e., 15–49 years of age, children, school age population, and adolescents. Around the world, especially in developing countries, there is an increasing concern and interest in maternal and child health care [53].

WHO Philippines MCH program works with local public health departments, community-based organizations, statewide organizations and other providers to provide and/or assure quality health services are delivered to mothers, children, and families in the country. The primary areas of work focus are increasing healthy birth outcomes; promoting and assuring comprehensive primary care for children, from birth to 21 year olds, including children with special health care needs; promoting healthy lifestyles among school-age youth, ages 6–21, including children with special health care needs; and promoting access to safe, healthy child care, including children with special health care needs; and to improve the survival, health, and wellbeing of mothers and unborn children.

Among the maternal health services are antenatal registration where pregnant women can avail free prenatal services at their respective health center; tetanus toxoid immunization – a series of 2 doses of tetanus toxoid vaccination must be received by a pregnant woman one month before delivery and 3 booster doses after childbirth; micronutrient supplementation – vitamin A and iron supplement for the prevention of anemia and vitamin A deficiency; treatment of diseases and other conditions for the women who are diagnosed as high risk.

Maternal health programs include a minimum of three pre-natal check-ups, as early as before 4 months or during 1st trimester, during the second trimester and during the third trimester or after 8 months. Another program is the provision of tetanus toxoid vaccine up to fifth dose which gives lifetime protection for the mothers. When given to women of childbearing age, vaccines that contain tetanus toxoid not only protect women against tetanus, but also prevent neonatal tetanus in their newborn infants.

3.2.5. Reproductive health and family planning program

In addition, MCH also includes a reproductive health and family planning program, which is a national mandated priority public health program to attain the country's national health development: a health intervention program and an important tool for the improvement of the health and welfare of mothers, children and other members of the family. It also provides information and services for the couples of reproductive ages to plan their family according to their beliefs and circumstances through legally and medically acceptable family planning methods.

Child health programs are designed for newborns, infants, and children and they are vulnerable to common childhood diseases. To address problems, child health programs have been created and are available in all health facilities, which includes infant and young child feeding, newborn screening, EPI, management of childhood illnesses, micronutrient supplementation, dental health, early child development and child health injuries. The main objective of child health programs is to reduce morbidity and mortality rates of children of 0–9 years [51].

3.2.6. Circumcision program

Circumcision is the process of removing the foreskin and exposing the end of the penis. It is believed that circumcised men will be at lower risk from acquiring sexually transmitted infections, as well as infection of the penis as the skin wherein some bacteria can accumulate are easily cleansed or removed. Circumcision is still performed using traditional methods in some remote areas in the country, where a local village circumciser will perform it using the "*pukpok*" method. The DOH is not against the "traditional way" or "*pukpok*" as long as tools to be used are clean and sterilized. However, they still encourage parents and young boys to undergo circumcision by a well-trained doctor or health professionals.

The Rural and Barangay Health Centers, through directives from Provincial Health Office, offer Oplan Tuli during summer to ensure free and safe circumcision of young boys. In addition, educational campaigns have been conducted to encourage young boys to undergo circumcision.

3.2.7. Expanded Immunization Program (EPI)

Immunization is a global health and development success story, saving millions of lives every year. Vaccines reduce risks of getting a disease by working with our body's natural defences to build protection. Immunization currently prevents 3.5–5 million deaths every year from diseases like diphtheria, tetanus, pertussis, influenza, and measles.

Immunization is a key component of PHC and an indisputable human right. It is also one of the best health investments money can buy. Vaccines are also critical to the prevention and control of infectious disease outbreaks. They underpin global health security and will be a vital tool in the battle against antimicrobial resistance [53].

The Philippines established the EPI in 1976 to ensure that infants/children and mothers have access to routinely recommended infant/childhood vaccines. Six vaccine-preventable diseases were initially included in the EPI: tuberculosis, poliomyelitis, diphtheria, tetanus, pertussis, and measles. The main objective of EPI is to reduce the morbidity and mortality among children against the most common vaccine-preventable diseases. Its specific goals are to immunize all infants/children against the most common vaccine-preventable

diseases; sustain the polio-free status of the Philippines; eliminate measles infection; eliminate maternal and neonatal tetanus; control diphtheria, pertussis, hepatitis b, and German measles; and prevent extra pulmonary tuberculosis among children.

One significant milestone under the EPI is that its budget allocation has continued to increase year by year. The Philippine government allocates budget for the immunization of all infants/children/women/older persons nationwide. The budget allocated for EPI in 2012 was PhP1.8 billion, and another PhP 1.5 billion was allocated for the immunization for senior citizen and children for the National Household Targeting System (NHTS) families. This is a great leap towards universal access to quality vaccines for the prevention of the most common vaccine-preventable disease in the country [54].

3.2.8. Curative care

Curative care is an important component of a health program adapted to the needs of a developing country. Initially however, more important measures have to be implemented to provide the foundations for all programs aimed at improving the health of a community [55]. Curative care refers to health care practices that treat patients with the intent of curing the patients, not just reducing their pain or stress. An example is chemotherapy, which seeks to cure cancer patients [56].

At the individual level, the objective of curative care is to cure the patient and to minimize or prevent the consequences of illness. At the community level, the objectives are to reduce the mortality and morbidity attributable to the common severe illnesses in the community. Curative care can reduce transmission of certain diseases (e.g., tuberculosis, leprosy, trypanosomiasis, bilharzia) provided a high proportion of the infected community is treated.

In the Philippines, curative care is embedded in the Universal Health Care of the National Health Insurance Program where it aims to protect all Filipinos, especially the poor, from the financial burden of accessing/availing preventive and curative healthcare services. It was established to help the people pay for health services; and to prioritize and accelerate the provision of health service to all Filipinos, especially the segment of the population who cannot afford these services [57].

The DOH has tuberculosis control program, control of acute respiratory infection, diarrheal disease program, cardiovascular disease prevention and control program, STD/AIDS prevention program, cancer prevention and control program, leprosy control program among its curative care.

3.2.9. Essential drugs

The Alma-Ata declaration during the International Conference on Primary Health Care in 1978 reaffirms that health is a fundamental human right and the attainment of the highest possible level of health is a most important worldwide social goal [34]. The Alma Ata declaration has outlined the eight essential components of primary health care and provision of essential medicines is one of them. Medicines are integral parts of the health care and the modern health care is unthinkable without the availability of necessary medicines. They not only save lives and promote health, but also prevent epidemics and diseases. The medicines are undoubtedly one of the weapons of mankind to fight disease and illness. Accessibility to medicines is too the fundamental right of every person.

The objectives of WHO's essential medicines and pharmaceutical policies programme are to save lives and improve health by ensuring the quality, efficacy, safety and rational use of medicines, including traditional medicines. It promotes equitable and sustainable access to essential medicines particularly for the poor and disadvantaged [54].

The 1987 Philippine Constitution mandates the right of every Filipino to health. It enunciates the policy that "the State shall protect and promote the health of the people and instill health consciousness among them" (Article II Section 15). Furthermore, it provides the adoption by the State of an "integrated and comprehensive approach to health development which shall endeavor to make essential goods, health and other social services accessible to all the people at affordable cost" (Article XII Section 15).

To support these goals, several policies and laws have been passed. These include Republic Act No. 6675 known as the Generic Act of 1988 that was enacted to "ensure the adequate supply of drugs with generic names at the lowest possible cost." It further states that "in the promotion of the generic names for pharmaceutical products, special consideration shall be given to drugs and medicines which are included in the Essential Drugs List to be prepared within 180 days from approval of this act and updated quarterly by the DOH on the basis of health conditions of the Philippines as well as internationally accepted criteria" [58]. The provision of anti-hypertensive drugs and antibiotics in RHUs are among the essential drugs program of the country.

3.2.10. Health education and health promotion

Health education is an effective tool that helps improve health in developing nations. It not only teaches prevention and basic health knowledge but also conditions ideas that re-shape everyday habits of people with unhealthy lifestyles in developing countries. Quality health is a fundamental right of all citizens. This can only be achieved through effective health care services.

Health education plays a crucial role in the development of healthy, inclusive, and equitable, social, psychological, and physical environments. It reflects current best practice, using an empowering, multi-dimensional, multi professional approach which relates to all settings and organizations, including communities, schools, health service institutions, and workplaces [59]. Health education helps to provide health knowledge, enhance wellness behaviors, promote health status, facilitate healthy relationships, and enables community members make responsible decisions. Health education is defined as any combination of planned learning experiences based on sound theories that provide individuals, groups, and communities the opportunity to acquire information and the skills needed to make quality health decisions. Health education at the PHC level help to address issues related to disease prevention; consumer health, environmental, emotional, and sexual health; first aid, safety, and disaster preparedness; and also substance abuse prevention.

3.2.11. Traditional and complementary medicine

Traditional and complementary medicine (T & CM) remains as one of the reliable sources of healthcare among rural areas and the poor. In 1992, the Traditional Medicine Program was launched by the DOH to promote traditional medicine in the country. This was followed by the passage of Republic Act 8423, or the Traditional and Alternative Medicine Act (TAMA) of 1997, which enabled the creation of the Philippine Institute of Traditional and Alternative Healthcare (PITAHC). This institute was established to encourage the development and research of traditional and alternative healthcare in the country. Currently, PITAHC has embarked on the following initiatives to carry out their mandate: (i) development of reference materials, standards, guidelines, and code of ethics on traditional and alternative medicine; (ii) advocacy for increased awareness and practice of T & CM through Traditional and Alternative Healthcare (TAHC) month, (iii) integration of T & CM services in two DOH-retained hospitals; and (iv) certification of TAHC practitioners and accreditation of TAHC facilities [60].

However, several issues are plaguing traditional medicine in the country. PITAHC currently lacks regulatory and enforcement powers to regulate the practice of T & CM in the country, which is important to ensure the provision of quality, safe, and effective T & CM services. There is also a lack of baseline data

on present T & CM modalities and the number of T & CM practitioners in the Philippines. Lastly, there are concerns on the sustainability of T & CM implementation in hospitals. This is due to a lack of staff and non-inclusion of T & CM services in the benefit package of PhilHealth.

3.2.12. Community development.

PHC is essential health care based on practical, scientifically sound, and socially acceptable methods and technology made universally accessible to individuals and families in the community through their full participation and at an affordable cost to maintain at every stage of their development in the spirit of self-reliance and self-determination. It forms an integral part both of the country's health system, of which it is the central function and main focus, and of the overall social and economic development of the community. It is the first level of contact of individuals, the family, and community with the national health system bringing health care as close as possible to where people live and work, and constitutes the first elements of a continuing health care process [54].

Community health workers are an important cadre of the PHC workforce in many low- and middle-income countries. The Philippines was an early adopter of the community health worker model for the delivery of PHC, launching the BHW program in the early 1980s [61].

3.3. Overview of current policies and systems of primary health care services

While the Philippines has delegated the responsibility for PHC to LGUs, explicit definition of the term is not perspicuous in the Implementing Rules and Regulations of the Local Government Code of 1991. Thus, even the DOH saw the importance of advocating the significance of the PHC philosophy through the issuance of the PHC policies or community health development in 1996 [62] which stressed the vision of "putting health in the hands of the people" through PHC to enable the people "to serve as active participants in attaining their own health needs" and not as "mere beneficiaries of development effort" [62]. To accomplish this mission, the policy paper also pointed out that "health is made accessible, available, acceptable and affordable at all times within the context of an effective and efficient devolved health care system that leads towards self-reliance, sustainability, and indigenous efforts" [62]. The policy paper promoted the importance of disseminating such strategies as community organizing to prepare the community for effective interface with government; convergence of civil society groups and other government agencies, apart from health; partnership with the community; focused targeting of marginalized sectors; utilization of the basic needs information system as a tool for planning; setting up community information systems for transparency; and indigenization to recognize local resources. The DOH sponsored the Training on Health in the Hands of the People to enrich the role of national health workers, especially the DOH representatives to the Local Health Board (LHB), as DOH sentinels in the local technical body. Some batches also involved local officials and local health workers in this training program on the essence of PHC philosophy, stressing the importance of the approach, apart from the promotive and preventive aspects of health.

3.4. Organization

With devolution, the key responsibility for PHC is delegated to the municipality and city [63]. Each municipality assumes the burden of implementing programs in promotive and preventive health care such as maternal and child-care, communicable and non-communicable disease control services, and purchase of medicines and medical supplies. Each municipality and city extend assistance to the lowest political boundary of the barangay which is responsible for the maintenance of BHSs, although the lack of resources hinders each LGUs' capacity to respond effectively to this role [64]. It may also maintain some hospitals in each LGU level (i.e., city or

municipality). In the case of the province, the highest political subdivision of the LGU, its basic responsibility is for curative services through the provincial hospitals maintained in the locality. The province is also charged with the provision of other support services under the provincial health offices that oversee the operation of the different hospitals in the locality. A total of 46,000 health workers were devolved by 1997, representing 75% of the field personnel of the DOH in that year [65].

3.5. Health Sector Reform Agenda

Since the devolution, the DOH has the role of "steering" LGUs towards PHC. Thus, it undertook major reform measures to enable the national office to perform an advocacy role, rather than as the implementer of health programs. The Health Sector Reform Agenda spelled out the key reform areas in national and local health management: (i) enhancing hospital systems at national and local levels by promoting fiscal autonomy, allowing them to collect socialized user fees and become more self-sufficient; (ii) ensuring sustainable funding for public health systems for programs targeting the elimination of infectious diseases and promoting preventive measures; (iii) improving local health systems by establishing local health zones to facilitate cooperation among LGUs and encouraging private sector participation in local health networks; (iv) strengthening health regulation agencies to guarantee the delivery of quality healthcare by both public and private facilities; and (v) enhancing health financing to expand participation in the National Health Insurance Program, particularly among the poor and informal sectors, who often lack access to quality healthcare due to limited resources and connections.

The DOH agenda and advocacy to set up an integrated approach to promotive and curative health care is realized through the provision of an integrable management concept of the District Health System and/or Inter-Local Health Zone [64]. This medical approach is characterized by collaborative and synergetic arrangements among the different LGUs to establish a structure by which an integrated health plan is formulated, incorporating two levels of the health care system: the referral hospital and the health centers, in conjunction with the satellite BHSs. This move is reinforced by the mandate to establish a National Health Planning Committee which institutionalizes the covenant among the Secretaries of the DOH, Department of the Interior and Local Government, and the Department of Budget and Management; Health Committee Chairmen of the Senate and House of Representatives; representatives of the private sector; and the president of the league of provinces. Thus, the collective participation of key players engenders an advantageous cost sharing among the members of the LGUs in the conduct of health programs and other related activities. The advantage of the district health system is the cost sharing agreement of the program. It also enables efficient utilization of resources across the different LGUs, reduction of outpatient load at the district hospitals and the furtherance of the referral system. In point of fact, it was observed that low-income families indicated the highest access rate of access to public health facilities. Of those who sought health services, 82% depended on public health facilities, with 61% consulting the RHUs/BHSs and 20% going to public hospitals [62].

A survey contracted by the World Bank in 2001 with Social Weather Stations disclosed that 37% of both public health facilities and government hospitals were accessed by respondents in the bottom 30% in expenditure class. However, the survey results braced earlier findings that those in the higher classes depended predominantly on private clinics/hospitals. In particular, the study revealed that those in the middle 30% and top 40% in expenditure class relied for the most part on private clinics/hospitals.

There is a substantial amount of literature covering both patient satisfaction and patient characteristics; in addition to aspects of care provided by hospitals related to patient satisfaction. Data from 21 European Union countries was analyzed to investigate the determinants of satisfaction with the health care system as it relates to patient experience [66]. The authors found out that satisfaction with the health care system depended more on

external factors such as the patients' expectations, health status, and type of care required, rather than on the experience of care as a patient. They assessed the extent to which direct access to health care services influences the satisfaction with general practitioner services in 18 European countries. The results showed that direct accessibility appeared to be important for patient satisfaction [67].

Several studies discussed the questionnaire's design, validity, and reliability as it related to patient satisfaction which divulged that nursing and doctor categories were most notable.

Also, several studies approached different aspects of patient satisfaction. Yet, there are very few studies that took account of the health care system reform program with regard to resident satisfaction. An evaluation of the primary health care reform in Estonia from patients' perspectives using interview data was conducted. On the other hand, with the deepening understanding of modern scientific management methods, hospital supervisors are paying increasing attention to the patients' suggestions and the doctor-patient consultation experience. This is because they are both important in a keenly competitive health care service market. Internationally, many scholars agree that patient satisfaction investigation and consultation experience investigation can be helpful in making sustainable improvements to medical services [68].

One study also aimed to describe how the characteristics of Rural Health Centers (RHCs) have either changed or remained stable over a 10-year period in the past: from the late 1990s to 2007. In addition, it also described some of the outstanding needs of RHCs as they navigate the transitions of U.S. health care reform. Using a panel of RHCs continuously in existence from 2006 through 2007, the authors calculated and compared statistics with interrelated statistics from the literature. They described the geographic distribution of RHCs, demographics of their counties of location, and characteristics of RHC structure and staffing. They also explored the implications of the recently enacted health reform law (the Patient Protection and Affordable Care Act or ACA) for RHCs, and the rescripting that RHCs need as it is implemented [69].

By the end of the study period, the highest percentages of RHCs were glimpsed in the South and Midwest, where noticeably the percentage of RHCs in the West had grown, and that in the South had declined. RHCs served counties with increasing proportions of individuals below poverty and Hispanics/Latinos. The percentage of independent clinics had grown, as had the percentage for profit clinics. Finally, the percentage of nurse practitioner full-time equivalents had grown as a proportion of the total for three providers.

The study's conclusion highlights that when examining the performance of RHCs, there is a lack of comprehensive understanding regarding many managerial and operational factors. It is crucial for RHCs to collect information that can aid them in optimizing their performance aspects, which, in turn, will contribute to their financial stability. In addition, a broader awareness of the unique challenges that RHCs face in this era of health care reform is needed.

The study titled "Effective Utilization of Healthcare Services in Rural Tamil Nadu, India" aimed to investigate the utilization of primary healthcare services in a primary health center and its sub-centers. The study also sought to identify the factors influencing service utilization in these healthcare facilities. This descriptive study was conducted at Orathur PHC, Cuddalore District, Tamil Nadu and its sub-centers, covering a population of 45,183 by using structured interview schedule with sample size of 3,220 (80 houses in each sub-center) using the simple random sampling technique. The results revealed that 60.2% of selected households are located beyond 5 kms. Out of 560 households, 552 are headed by males and the remaining females. 71.96% of study subjects had formal education. 85.5% of respondents were aware of the PHC services. 71.2% of respondents had satisfactory opinion about health services. Only 45.40% and 58.80% of the patient's households with acute & chronic illness had utilized PHC services, respectively. 81.65% of the antenatal care mothers had utilized PHC services, 77.98% had received tetanus toxoid immunization, 75.24% had utilized

delivery services, 75.76% had sought postnatal care, and 79% had immunized their children. It was concluded that the utilization of primary level services (PHC and Subcenters) is better for preventive and promotive care but is ineffectual in the treatment of acute illness, intra-natal care and family welfare, and special investigation services [70].

Another study was conducted identify perceptions of the quality-of-service provision in a rural area of the Limpopo Province. It was an attempt to identify factors that are related to quality improvement in primary health care centers in the central region of the Limpopo Province to be used as inputs to a more effective approach in improving the quality of health care among the consumers of that region. They surveyed the perceptions on the quality of primary health care services provided in rural communities in the Limpopo Province. Ten focus groups discussions were held with community members chosen by convenience from public places from four villages in the central region of the Limpopo Province. The sample included 42 women and 34 men (76 participants). Results indicated perceived quality discussed within the following categories: (i) conduct of staff (reception, communication, discrimination, care and compassion, and respect for privacy), (ii) technical care (examination, explanation of treatment, responsiveness, treatment outcomes), (iii) health care facility, (iv) health care organization, (v) drugs (availability, explanation, effectiveness, and payment), and (vi) waiting time.

The findings indicated a certain level of satisfaction regarding the availability of free basic and preventive health care services and social services. However, there is a need to focus on the interpersonal aspect of service delivery, including providing medication with clear explanations to patients. Additionally, addressing structural issues is essential, and it's recommended that the government provides support to clinics to ensure they can offer adequate services. To enhance the perceived quality of primary healthcare and inform health policy action, it is crucial to prioritize three main areas: improving drug availability, enhancing interpersonal skills, including attitudes towards patients, and ensuring high-quality technical care [71].

In the Philippines, there are only a few studies conducted that focused on the effectiveness of primary health care services in the country. One study found that despite achieving some success, wealth-related disparities in the utilization of maternal and child health services persist in the Philippines. The objective of the said study was to decompose the principal factors driving the wealth-based utilization gap.

The authors of this study used national representative data from the 2013 Philippines Demographic and Health Survey to investigate the extent to which variations in the utilization of maternal health services can be attributed to observable factors. They employed nonlinear Blinder-Oaxaca-type decomposition methods to quantify how differences in measurable characteristics contribute to the wealth-based coverage gap in facility-based delivery.

The study has found moderate wealth-based disparities in the utilization of institutional delivery in the Philippines. The results confirm the importance of recent efforts made by the Philippine government to implement equitable, pro-poor focused health programs in the most deprived geographic areas of the country. It is crucial to prioritize addressing the social determinants of health, with a specific focus on education. Additionally, there is a need to develop and implement effective strategies to promote institutional delivery for higher-order births [72].

4. Methods

4.1. Research design

In this study, a non-experimental, descriptive research method was employed. This approach was chosen because it offers descriptive insights into the effectiveness of PHC services provided in the RHUs of the

Province of Batangas.

The essence of survey method can be explained as "questioning individuals on certain topic(s) and then describing their responses" [73]. Besides, the descriptive method is widely used in most branches of science, including social sciences.

A descriptive study is one in which information is collected without changing the environment. It is used to obtain information concerning the current status of the phenomena to describe "what exists" with respect to variables or conditions in a situation [74].

This method was chosen because it best fits the study's goal of assessing the effectiveness of PHC services in Batangas municipalities without altering the environment.

4.2. Participants of the study

Convenience sampling was used in the selection of the respondents, enabling the inclusion of all residents who were availing primary healthcare services in rural health units during the data gathering period as study participants.

At a 95% confidence level with a 5% margin of error, the sample size calculator indicated that the recommended sample size for this study was 384. A total of 384 residents from 12 municipalities were asked to participate as respondents of this study (**Table 1**). Their experience and perception on the PHC services offered by the rural health units served as the backbone of this study.

Table 1. Participants of the study

Barangay and municipality	No. of participants
Barangay Matabungkay, Lian (first district)	48
Barangay Buli, Taal (first district)	51
Barangay Luntal, Tuy (first district)	32
Barangay Dulangan, San Luis (second district)	27
Barangay San Juan, Tingloy (second district)	21
Barangay Coral na Munti, Agoncillo (third district)	38
Barangay Poblacion West, Alitagtag (third district)	25
Barangay Malabanan, Balete (third district)	46
Barangay Dita, Cuenca (third district)	41
Barangay District III, Mataas na Kahoy (third district)	30
Barangay Poblacion, San Nicolas (third district)	29
Barangay Calayaan, Santa Teresita (third district)	21

4.3. Instrument

The main data gathering instrument that was used in this study is a self-made questionnaire based on the national programs provided by the DOH in order to determine the effectiveness of the primary health care services. The survey questionnaire was validated by experts to ensure that all the items were relevant to the study.

The questionnaire was structured into two sections. The initial section addressed the respondents' demographic information, while the second section concentrated on assessing the effectiveness of PHC services.

Equivalent verbal interpretations using the Likert scale was utilized to interpret the numerical data

gathered.

The score on the scale is the average of the weight assigned to the particular response made by the respondents. To be able to interpret the responses on the scale, the following range of mean and their corresponding adjective ratings was observed: 3.31 – 4.00 for “highly effective”; 2.61–3.30 for “effective”; 1.81-2.60 for less effective; and 1:00–1.80 for “not effective.”

The questionnaire contained a confidentiality clause whereby respondents were informed that their answers will be treated with utmost privacy.

4.4. Data collection

Before the data gathering activity, a letter of request for permission to conduct interview along with the approved survey questionnaire was submitted to the various mayoralty office thru their Municipal Rural Health Officers for approval and endorsement. Upon approval of request, distribution of the survey instruments followed. Patients availing of primary health care services in the rural health units were asked to participate in the survey.

Before the conduct of the survey, the nature of the study and the survey questionnaire were explained. Adequate time were given to ensure that all the questions in the survey form have been fully understood and answered by the respondents. A total of 384 respondents successfully answered the survey questionnaire. The data collected from these questionnaires were statistically processed followed by the generation of various statistical tables.

4.5. Ethical considerations

In this study, a letter of permission was included in the questionnaire as it is important to establish trust by ensuring anonymity and confidentiality of all respondents. The data collected via the questionnaire were obtained from residents in the chosen municipalities who were using primary health services, and their information was treated with utmost confidentiality. Alongside the confidentiality assurance, respondents were informed of their right to withdraw their participation, even in the midst of answering the questionnaire or during the interview. Fortunately, all 384 respondents cooperated and successfully completed the survey questionnaire.

4.6. Data analysis

To perform data analysis, several statistical tools were used. Frequency distribution was used to determine the profile of the respondents in terms of age, sex, educational attainment, number of times PHC was availed of from the municipality. Weighted means and ranking was used to assess the effectiveness of PHC services offered in the municipality with regards to maternal and child health program, EPI, tuberculosis control program, nutrition program, control of acute respiratory infection, environmental sanitation, diarrheal disease program, cardiovascular disease prevention and control program, dental health program, reproductive health and family planning program, voluntary blood donation program, rabies control program, STD/AIDS prevention program, cancer prevention and control program, leprosy control program and health education, circumcision program, and health education and health promotion.

The normality status of the data was tested vis-à-vis the result of the Shapiro-Wilk test which revealed that *P-values* of two major variables were less than 0.05, which meant that the data set was not normally distributed. Consequently, the Mann Whitney U and Kruskal Wallis tests were used to test the significant difference in the effectiveness of PHC services when grouped according to profile variables. The data sets were processed using SPSS 26.0 to further interpret the results of the study, with $\alpha = 0.01$.

5. Results and discussion

Table 2. Percentage distribution of respondent's demographic profile

Profile variables	Frequency	Percentage (%)
Age		
18 to 28 years old	62	15.2
29 to 39 years old	101	24.7
40 to 50 years old	146	35.7
51 years old and above	100	24.4
Sex		
Male	146	35.7
Female	263	64.3
Educational attainment		
Elementary undergraduate	13	3.2
Elementary graduate	23	5.6
High school undergraduate	38	9.3
High school graduate	123	30.1
College undergraduate	113	27.6
College graduate	99	24.2
Barangay and municipality		
Barangay Matabungkay, Lian (first district)	48	11.7
Barangay Buli, Taal (first district)	51	12.5
Barangay Luntal, Tuy (first district)	32	7.8
Barangay Dulangan, San Luis (second district)	27	6.6
Barangay San Juan, Tingloy (second district)	21	5.1
Barangay Coral na Munti, Agoncillo (third district)	38	9.3
Barangay Poblacion West, Alitagtag (third district)	25	6.1
Barangay Malabanan, Balete (third district)	46	11.2
Barangay Dita, Cuenca (third district)	41	10.0
Barangay District III, Mataas na Kahoy (third district)	30	7.3
Barangay Poblacion, San Nicolas (third district)	29	7.1
Barangay Calayaan, Santa Teresita (third district)	21	5.1

Table 2 presents the overall distribution of the respondents' profile. In terms of age, most of them fell under the age bracket of 40 to 50 years old, with a frequency of 146 or 35.70%, while only 15.2% were 18 to 28 years old. The findings can be linked to the demographic composition of the survey sample. Most of the residents surveyed in their households fell within the age group of 40–50 years. Additionally, it was observed that individuals in the 18–28 age bracket often declined to provide data, citing reasons like not having utilized medical services or having limited knowledge about government health services. This aligns with the findings that individuals in the younger age group had a low level of awareness and understanding of the government's health programs, their purposes, and activities [75].

The study was also dominated by female respondents, which had a frequency of 263 (64.3%), while male respondents only accounted for 35.70%. More females were willing to participate in the survey. Also, when male respondents were asked to participate, they would often ask their wives or daughters to answer for them. This is in agreement with the notion that women are more likely to participate than males in surveys [76].

As to educational attainment, most of the respondents are high school graduates, represented by a frequency of 123, followed by college undergraduates and college graduates. This finding may be attributed to the fact most residents of Batangas Province are high school graduates. Therefore, most of the respondents were from this age group. Furthermore, this discovery aligns with a broader trend identified in research, which suggests that, as a general pattern, individuals with higher education levels and greater financial resources are more inclined to participate in surveys compared to those with lower education and fewer financial means [77].

Lastly, as to the distribution of barangay, most of them are from Buli (12.5%), Matabungkay (11.7%), and Malabanan (10.0%). This can be simply credited to the fact that Buli has the greatest population amongst the barangays included in this study.

Table 3. Effectiveness of PHC in terms of environmental sanitation

Indicators	Weighted mean	Verbal interpretation	Rank
(i) Water sanitation: inspection of water supplies, sample collection, disinfection of newly constructed or contaminated water sources, monitoring and sample collection of water refilling stations, and water chlorination	2.69	Effective	2
(ii) Construction of sanitary toilet: household survey, issuance of toilet bowls, and regular monitoring	2.63	Effective	4
(iii) Food sanitation: inspection of food establishments, training of food handlers, and salt testing.	2.70	Effective	1
(iv) Dengue prevention and control: information, education, and communication (IEC)/lecture and school misting and monitoring.	2.68	Effective	3
Composite mean	2.67	Effective	

Note: 3.50–4.00 = Highly effective; 2.50–3.49 = Effective; 1.50–2.49 = Less effective; 1.00–1.49 = Not effective

Table 3 illustrates the effectiveness environmental sanitation program which corresponds to safe water and sanitation of the Alma Ata Declaration of 1978. All the evidences were positively assessed as effective, with the item "food sanitation: inspection of food establishments, training of food handlers, and salt testing" ranking first with a mean value of 2.70. This finding is surprising as when respondents were asked if they have personally witnessed the inspection of food establishments, not one did. The favorable perception regarding the effectiveness of inspecting food establishments, training food handlers, and conducting salt testing can be attributed to the respondents' belief that Local Government Units (LGUs), through the Business Permit and Licensing Office (BPLO) and Sanidad Office, were responsible for these activities. Respondents may have also been aware of food handlers receiving training during their pre-employment orientation. This aligns with a similar study that revealed LGUs were responsible for overseeing food establishments at the local level, while the FDA had oversight at the national level [78]. Thus, it can also be deduced that there exists a strong public confidence on the work done by the LGUs in effectively conducting food sanitation programs.

Second in rank, with a mean of 2.69, "Water sanitation: inspection of water supplies, sample collection, disinfection of newly constructed or contaminated water sources, monitoring and sample collection of water refilling stations, and water chlorination" was found to be effective.

The water refilling station must obtain a satisfactory rating from the City or Municipal Health Office

before a sanitary permit is issued. A score of 50 out of 100 points in a 20-item checklist of DOH standards would be needed to obtain a satisfactory rating. The City or Municipal Health Office is mandated to conduct annual sanitary inspections for all water refilling stations before issuing a sanitary permit. No person or entity is allowed to operate a water refilling station without a sanitary permit [79]. Therefore, the respondents believed that water stations met sanitation requirements before starting operations. This suggests trust in the local government, especially the Sanidad Office within the City or Municipal Health Office, to carry out their duties effectively. In addition, it was reported that 89.38% of Batanguenos have access to safe water [80].

Third in rank, "Dengue prevention and control: IEC/lecture and school misting and monitoring" had a weighted mean of 2.68, meaning that it was effective. It should be noted that according to the barangay officials and employees, misting is only conducted when there is a positive dengue case. However, the information and educational campaign against dengue has been regularly conducted by rural health midwives and BHWs. These campaigns are conducted in conjunction with other activities such as during Usapang Buntis and Operation Timbang to ensure that parents or guardians are made aware of the importance and ways of preventing dengue. This finding aligns with a previous study that showed communities in Batangas are compliant with dengue prevention and control programs [81].

On the other hand, although still verbally interpreted as effective, the lowest on the rank was "construction of sanitary toilet: conducting household survey, issuance of toilet bowls, and regular monitoring," with a mean value of 2.63. The effective perception of the respondents on the construction of sanitary toilets is supported by the recent statistics published [82], 88.17% of households in Batangas has sanitary toilets, a combination of bathrooms that are either privately-bought or those installed by the LGUs. Some respondents stated that before the Covid19 pandemic, their LGUs would sometimes issue sanitary toilets. For the conduct of household survey, the BHWs took note of the households without their own toilet bowls and to bring their data when asked to be submitted by the City/Municipal Health Office. Other national household surveys, such as the Population Census, CBMS and NHTS Listahanan also gathered data on the status of household sanitary toilets.

Table 4. Effectiveness of PHC services in terms of nutrition program

	Indicators	Weighted mean	Verbal interpretation	Rank
(i)	Operation Timbang: mass-weighing of 0–11 months children, treatment of malnourished children with primary complex, de-worming of malnourished children, and feeding of malnourished children (3 times a week for 6 months).	2.90	Effective	1
(ii)	Micronutrient supplementation: giving Vitamin A capsule to children aged 0–71 months and distributing iron tablets to pregnant and lactating mothers to reduce and control iron-deficiency anemia.	2.81	Effective	2
(iii)	Nutrition advocacy: giving dietary counselling on modified diet and organizing PABASA classes	2.70	Effective	3
(iv)	Salt iodization: promoting iodized salt to prevent simple goiter; conducting self-testing at markets, sari-sari stores, and households; enforcing the ASIN ordinance.	2.61	Effective	5
(v)	Food fortification: promotion of Sangkap Pinoy products to increase dietary intake of Vitamin A, iron, and iodine.	2.69	Effective	4
	Composite mean	2.74	Effective	

Note: 3.50–4.00 = Highly effective; 2.50–3.49 = Effective; 1.50–2.49 = Less effective; 1.00–1.49 = Not effective

Table 4 presents the observation of the respondents on the effectiveness of a nutrition program. Among

the items cited, “Operation Timbang: Mass-weighing of 0–11 months children, treatment of malnourished children with primary complex, deworming of malnourished children, and feeding of malnourished children (3 times a week for 6 months) received the highest mean of 2.90, which indicates that it is effective. This finding may be attributed to the presence of a BNS who weighs all children up to the age of 5 and keeps record of all their immunization details, including intake of vitamin supplements and deworming particulars. When a BNS suspects malnourishment, he/she directly reports the case to the Municipal Nurse and the Municipal Social Welfare and Development Office (MSWDO). Subsequently, malnourished children receive supplementary feeding under the direct supervision of the BNS.

Second in rank, with a mean of 2.81, “Micronutrient supplementation: giving Vitamin A capsule to children aged 0–71 months and distributing iron tablets to pregnant and lactating mothers to reduce and control iron-deficiency anemia” was also found to be effective by the respondents. This finding may be attributed to the free vitamin A capsules that are provided to children of 0–71 months old by the RHUs. According to BHWs encountered during the data-gathering, children of 0–71 months old are tracked and given vitamin A orally. Moreover, mothers who attend maternal health care services are provided with folic acid and iron tablets to fight anemia during pregnancy. The effectiveness of this indicator, as perceived by the respondents, could be attributed to the supplements being both adequate and provided for free.

With a mean of 2.70, the third in rank, the respondents perceived the promotion of nutrition advocacy through giving dietary counselling on modified diet and organizing PABASA classes was effective.

The PABASA sa Nutrisyon Program aims to educate caregivers of families on proper nutrition practices and healthy lifestyle to reduce the risk of malnutrition in the family. It is a 10-week course conducted by the Philippine Nutri-Foods Corporation in coordination with the health and nutrition workers such as rural health midwives, BNS, BHWs, and NGO volunteers. PABASA sa Nutrisyon is an informal and fun learning activity where parents receive an in-depth and comprehensive training on proper nutrition. A variety of demonstrations, exercises, and games are held to help the parents better understand the importance of proper nutrition and the risks of malnutrition on their children. This program provides convenience to rural health officers who need educational materials and tools for promotion of health and nutrition education. PABASA materials can be used repeatedly because they are made of sturdy materials. Since this program was temporarily halted during the pandemic, the respondents answered based their personal experience of this program during the pre-COVID-19 period.

The respondents also finds food fortification in terms of promoting of Sangkap Pinoy products to contribute to increased dietary intake of Vitamin A, iron and iodine effective, although it had the lowest mean score of 2.69. The DOH through the Bureau of Food and Drugs (BFAD) sets the standards in the mandatory fortification of the following staple foods: (i) rice - with iron; (ii) wheat flour - with vitamin A and iron; (iii) refined sugar - with vitamin A; and (iv) cooking oil - with vitamin A. To promote food fortification, Sangkap Pinoy Seal is a government program established to encourage food manufacturers to market high-quality fortified food products. The seal is awarded to manufacturers who are able to meet standards for fortifying products with vitamin A, iron, or iodine. Respondents ranked this indicator as second to last because some had questions that required clarification during data collection. Although they remembered hearing about it through radio and TV advertisements, they could not associate the information with the government’s project. Some even perceived it as merely an advertising campaign to promote specific brands of fortified food. They also said that they did not hear about it from their rural health centers or barangay health center. However, they admitted that they prefer[red] buying food with Sangkap Pinoy Seal than non-fortified items because they believed it is healthier.

Lastly, with a mean of 2.61, the respondents find “salt iodization: promoting iodized salt to prevent simple goiter; conducting self-testing at markets, sari-sari stores, and households; enforcing the ASIN ordinance”

effective. The respondents remembered that the LGU conducted tests on the salts in the market and BHWs conducted tests on their household salt. However it was not periodically and regularly done. Some even argued that the implementation of the ASIN Ordinance was strict at some time but also became lenient at a later time. Some even believed that the testing and implementation of the ordinance completely stopped even years before the COVID-19 pandemic hit the country.

With a composite mean of 2.74, it can be said that the PHC services in terms of nutrition program in the province of Batangas is effective. This is parallel to study where respondents rated their satisfaction of the nutrition service as above average in Bangladesh [82]. However, it must be noted that the efficiency of the nutrition service in both studies relied solely on the work done by the CHWs.

Table 5. Effectiveness of PHC services in terms of maternal and child health program

Indicators	Weighted mean	Verbal interpretation	Rank
(i) Provision of intensive care to mother during pre-natal and post-partum period.	3.02	Effective	1
(ii) Provision of adequate care and treatment for some common childhood illnesses of 0–5 years old as well as protection and promotion of good health.	2.98	Effective	2
(iii) Provision of facility-based delivery.	2.22	Less effective	4
(iv) Promotion of social awareness through conduct of dialogue meeting in mothers' class and bench conferences, intensified pregnancy tracking, Buntis Congress and Safe Motherhood, and Usapang Buntis Awareness.	2.85	Effective	3
Composite mean	2.77	Effective	

Note:3.50–4.00 = Highly effective; 2.50–3.49 = Effective; 1.50–2.49 = Less effective; 1.00–1.49 = Not effective

Table 5 shows an assessment of the respondents on the effectiveness of primary health care services in terms of maternal and child health program. Among the activities cited, provision of intensive care to mother during pre-natal and post-partum period recorded the highest mean of 3.01 which implies that the Batangas Province is effective in providing pre-natal and post-natal care health services offered through RHUs and cascaded to barangay health centers. During the prenatal period, pregnant women are diligently listed by BHWs and are encouraged to attend counselling sessions and regular check-ups held at the barangay health centers except Poblacion, San Nicolas. According to a member of the Sangguniang Barangay of Poblacion, San Nicolas, to date, there are no barangay health centers in the municipality and that all check-ups and other health services are instead provided for in the RHU. When pregnant women fail to attend, BHWs would fetch them from their homes and bring them to the health centers.

During data gathering, BHWs highlighted the challenges they have encountered when trying to encourage pregnant women to adhere to their recommended consultation schedules for pre- and post-natal care. They pointed out that some mothers could not visit RHUs due to work commitments, while others were concerned about the financial burden associated with consultations, including laboratory fees and the high cost of medicines. As a result, these mothers prioritized earning a livelihood over visiting barangay health centers and RHUs, where they anticipated incurring these expenses. This finding is consistent with the national survey where only 84% of pregnant women were recorded to have received antenatal checkups in the Philippines. Although many mothers have received antenatal check-ups, there are still mothers who are opposed to these medical check-ups.

During these check-ups, pregnant women are lectured by the midwives on the significance of prenatal care

visits to a health center, the required preparations for delivery, and crucial health information during pregnancy. Additionally, assessments of abnormal ante-, intra-, and post-natal signs and symptoms are conducted by the midwives, and if any are identified, referrals to higher health facilities for suitable management are made. Pregnant women are also advised by the midwives to take vitamins and supplements, particularly folic acid and iron for addressing anemia during pregnancy, and to receive tetanus vaccinations, which are often provided free of charge by the health centers. Midwives also discourage traditional birthing at homes and refer pregnant women to lying-ins and obstetricians/gynecologists when they detect risks. The effort of the BHWs and the midwives are appreciated by the respondents wherein the effectiveness of the pre- and post-natal services of the province of Batangas can be attributed to. This vital role of midwives and BHWs is also evident in the study where they play an important role in assessing pre-natal and postpartum health conditions [83].

This finding is parallel to results of the study where a high level of satisfaction by respondents was observed as having a high quality of maternal health services among pre- and antenatal attendees such as those recorded in Anambra State, southeast Nigeria [84].

Another study done locally also supports the finding of this study [85]. In the said study, Mothers evaluated the extent of prenatal health services rendered by health workers as “very good” with a mean of 4.14 in the RHUs of Region III.

Second in rank, with a mean of 2.98, the respondents perceived the provision of adequate care and treatment for some common childhood illnesses of 0–5 years old as well as protection and promotion of good health as effective. This may be attributed to the EPI implemented in the Barangay Health Centers aimed to reduce infant and child mortality due to seven immunizable diseases, i.e., diphtheria, tetanus, pertussis, tuberculosis, poliomyelitis, Hepatitis B, measles, rubella, along with the provision of other basic immunization services for infants and children below eight years of age [85].

Respondents perceive the provision of early childhood health services as effective because it grants their children access to vaccines that can be costly when obtained from private clinics and doctors. Moreover, BHWs frequently conduct home visits to communicate the upcoming vaccination schedule. In instances where parents miss scheduled vaccinations, these same BHWs visit their homes and ensure they receive the necessary vaccinations.

In addition to BHWs, a BNS is present in every barangay. They are in-charge of all the health records of children of 0–5 years old and pregnant and lactating mothers. They are responsible for delivering nutrition services in the barangay. Under their watch, the weight of the 0–5 years of age are periodically recorded. When a child is recorded as underweight, a report is submitted to the RHU and the City or Municipal Social Welfare and Development for the proper feeding of the children. The food supply for the malnourished children will be provided through the BNS. This includes milk, bread, meat, fruits, and vegetables. The malnourished children are closely monitored by the BNS until they have fully recovered. Fortunately, none of the respondent-barangays have malnourished children during the period of the study. However, the respondents believe that their BNS are always on hand, always reminding them of the vaccination schedules and proper caring of their children.

Certain medications are readily available in RHUs in most of the barangays in Batangas. Paracetamol for fever, salbutamol, and vitamins are almost always available for children when they are sick. All the parents have to do is to bring their children for check-ups at the RHU or in the case of San Luis, at their Barangay Health Center.

With all these pronouncements, it is not surprising that the respondents believe that the province of Batangas is effective in provision of adequate care and treatment for some common childhood illnesses as well as ensuring protection and promotion of good health.

Lastly, with an average rating of 2.85, the respondents viewed the promotion of social awareness through activities like conducting dialogue meetings in mothers' classes, bench conferences, intensified pregnancy tracking, Buntis Congress, Safe Motherhood initiatives, and Usapang Buntis Awareness as effective. This finding directly corresponds to another research study on the provision of intensive care to mothers during their pre-natal period which has been proven as likewise effective. Barangay Health Centers have a scheduled Buntis Congress and Usapang Buntis Awareness during every scheduled consultation for pregnant women. Before the check-ups, a bench conference is held first where rural health midwives would provide lecture and dialogues on social awareness and topics related to pregnancy. Although it must be noted that the COVID-19 pandemic brought a temporary halt to the conduct of these meetings and conferences, albeit it is slowly getting back to its normal procedure and schedules. The BHWs are effective in conducting intensified pregnancy tracking, thus, no pregnant woman is left behind with no knowledge on the proper care and nutrition. In Buli, the Secretary stated that when a pregnant woman does not attend the scheduled bench conferences or meetings, the BHW concerned and a Barangay Tanod will fetch expectant mothers using the Barangay Patrol. This is to guarantee 100% attendance to said activities.

However, provision of facility-based delivery was less effective as indicated by the mean value of 2.22. This may be due to the fact that of all the barangay-respondents, only Barangay Dulungan in the Municipality of San Luis have access to free facility-based delivery provided by their LGU. Neighboring towns, such as Cuenca, San Nicolas, and Sta. Teresita also relies on the Municipality of San Luis for free facility-based delivery. Residents rely on government hospitals but there are not enough beds to accommodate them, especially during the pandemic. Individuals with additional financial resources often choose private hospitals for healthcare services, while beneficiaries of the 4Ps program typically opt for lying-in clinics or the nearest birthing facility that provides services with no cost to patients. .

In the whole province of Batangas, there are only four government-run hospitals. The Batangas Provincial Hospital in Batangas City, Lipa City District Hospital in Lipa City, Don Manuel M. Lopez Memorial District Hospital in Balayan, Batangas and the Apacible Memorial Hospital in Nasugbu, Batangas. These hospitals cannot cater to the 2,908,494 total population of Batangas in 2020. Even before the COVID-19 pandemic, there has been lack of hospital beds, particularly on maternity wards. The lack of free birthing facilities and maternity beds in government hospitals may be the reason why this indicator was perceived by many residents of Batangas as less effective.

Overall, with a composite mean of 2.77, the maternal and child health program's PHC services in the Batangas Province are perceived as effective. This observation aligns with a study that found the health services delivered by RHUs in Region III, Philippines, to also be effective [85].

Table 6. Effectiveness of PHC in terms of reproductive health and family planning program

	Indicators	Weighted mean	Verbal interpretation	Rank
(i)	Community awareness: conducting pre-marital counselling to pre-married couples for the promotion of responsible parenthood	2.66	Effective	3
(ii)	Natural family planning: helping married couples of reproductive age to learn and practice natural family planning method*s*	2.71	Effective	1
(iii)	Temporary and permanent family methods: promotion of family planning services available through bench conferences and household teachings.	2.69	Effective	2
	Composite mean	2.68	Effective	

Note:3.50–4.00 = Highly effective; 2.50–3.49 = Effective; 1.50–2.49 = Less effective; 1.00–1.49 = Not effective

Table 6 reveals the overall effectiveness of the reproductive health and family planning program. Among the listed items, "natural family planning: helping married couples of reproductive age to learn and practice natural family planning methods" received the highest ranking with a mean score of 2.71, followed by "temporary and permanent family methods: promoting family planning services through bench conferences and household teachings."

However, "community awareness: conducting pre-marital counseling for pre-married couples to promote responsible parenthood" was also viewed as effective, albeit receiving the lowest rating among the mentioned items. Pre-marital counseling or pre-marriage orientation and pre-marriage counseling is a pre-requisite in securing a marriage license. The would-be-married couples, who are applying for a marriage license at the Local Civil Registry Office (LCRO), are required to personally attend the pre-marital counselling. The effective perception may be credited to the teachings of responsible parenthood, family planning, marriage and relationship, and breastfeeding and infant nutrition during the counseling. The respondents believed that pre-marital counseling is effective in preparing them for responsible parenthood and successful married life. This finding aligns with a study that indicated that premarital counseling can encompass a broad spectrum of knowledge, covering topics such as the objectives of marriage, understanding the psychology of men and women, grasping the appropriate criteria for marriage, and recognizing the essential prerequisites for entering into marriage, all contributing to education in this context. It also helps couples become fully aware of important areas of reproductive health issues and base their sexual relationships on the right foundation [85]. Generally, pre-marital counselling helps couples prepare for marriage and has an effect on creating a happier and more stable life.

Table 7. Effectiveness of PHC services in terms of circumcision program

	Indicators	Weighted mean	Verbal interpretation
(i)	Conducting master listing and promoting circumcision through Information, Education, and Communication (IEC) materials.	2.52	Effective

Note:3.50–4.00 = Highly effective; 2.50–3.49 = Effective; 1.50–2.49 = Less effective; 1.00–1.49 = Not effective

The circumcision program, which focused on master-listing and promoting circumcision through IEC materials was considered effective. The Rural and Barangay Health Centers offer Oplan Tuli during summer for the free and safe circumcision of young boys. In addition to that, information and educational campaign are conducted to encourage young boys to undergo circumcision (**Table 7**).

The effectiveness of the IEC is evident in the record of the barangays where all of the respondent-barangays reported that all young boys are eager to undergo circumcision, with the more affluent even going to private doctors to be circumcised. A study also showed that 95% of children are circumcised between 2 to 14 years of age in the Philippines [87].

Table 8. Effectiveness of PHC services in terms of EPI

	Indicators	Weighted mean	Verbal interpretation	Rank
(i)	Provision of routine immunization every Wednesday and other days of the month with antigens to 0-12 months.	2.92	Effective	1.5
(ii)	Intensified tracking of children 0-11 months for immunization.	2.92	Effective	1.5
(iii)	Provision of adequate logistics and supplies and cold chain equipment.	2.60	Effective	3
	Composite mean	2.82	Effective	

Note:3.50–4.00 = Highly effective; 2.50–3.49 = Effective; 1.50–2.49 = Less effective; 1.00–1.49 = Not effective

All items in **Table 8** were rated as effective. The provision of routine immunization every Wednesday and other days of the month with antigens to 0–12 months and intensified tracking of children 0–11 months for immunization both obtained the same mean score of 2.92. Though effective, it must be noted that the schedule of the immunization on the province of Batangas does not always fall on a Wednesday. As per the information provided by the BHWs, the day depends on the availability of rural health doctors, nurses, or midwives. As they serve the entire municipality on the same day, they allocate specific days for each barangay.

On the same note, the effectiveness of the immunization program may be attributed to the hard work of the BHWs who are the main arm in intensifying the tracking of children aged 0–11 months for immunization. Each BHW has an assigned sitio with corresponding assigned households. They are the ones who track and inform the parents of the children on immunization schedules. During the time when there was a vaccine-scare brought about by Dengvaxia issue, so some mothers refused to have their children vaccinated. It was the BHWs who encouraged them to trust the vaccines. When the parents still refused, the Barangay Patrol with a Barangay Tanod and designated BHW would fetch them from their houses. These effort and hard work are the main contributing factor for the effectiveness of the immunization program of the province of Batangas.

Meanwhile, provision of adequate logistics and supplies and cold chain equipment ranked the least. Though a mean of 2.60 was still considered as effective, this general opinion ranked the lowest because the respondents believed that the Barangay Health Centers and RHUs still lack the required logistics and supplies. During immunization scheduled to distant barangays, it was the barangay authorities who provided vehicles for the transportation of the nurses and doctors. A respondent also stated that sometimes they would hand out cash donations for the procurement of syringes.

With a composite mean of 2.82, the assessment of the respondents on the effectiveness of PHC services in terms of expanded program on immunization was viewed as effective. There have been no published studies to support nor refute this finding, however, national assessment on the immunization revealed that our country failed to reach its 95% target coverage, unlike its neighboring ASEAN countries, [88] thereby giving the impression that immunization efforts in the country is still not effective.

Also, the latest study conducted in Pakistan on 2008 differed in the present study. It revealed that immunization days have a negative impact on the immunization coverage and that its effectiveness is hampered by the inadequate mobility of health workers [89]. Fortunately, in the Philippines or particularly the province of Batangas, the health workers are the main reason for the effectiveness of the immunization program.

Table 9. Effectiveness of PHC services in terms of tuberculosis control program

Indicators	Weighted mean	Verbal interpretation	Rank
(i) Conducting case-finding activity: identification of tuberculosis symptoms, direct sputum smear microscopy, and gene-expert and purified protein derivative (PPD) testing.	2.80	Effective	2
(ii) Providing treatment for positive cases.	2.85	Effective	1
Composite mean	2.83	Effective	

Note:3.50–4.00 = Highly effective; 2.50–3.49 = Effective; 1.50–2.49 = Less effective; 1.00–1.49 = Not effective

Table 9 presents the respondents' assessment of the effectiveness of primary healthcare services, specifically in the context of the tuberculosis control program. Both components of the program received positive evaluations, with the ability to provide treatment for positive cases receiving a mean score of 2.83, and the capacity to conduct case-finding activities, including identifying tuberculosis symptoms, direct sputum smear microscopy, gene-expert, and PPD testing, scoring 2.80.

Directly observed treatment strategy may be the most effective approach in the diagnosis, treatment, and control of tuberculosis. When a patient shows symptoms of tuberculosis, he/she will be advised to approach his/her designated BHWs, where he/she will undergo a sputum test. When the test yields a positive result, the patient will have to undergo counselling followed by a six-month period of continuous medication provided by the RHUs. The patients' household members will be educated on the proper care of tuberculosis patients. Whenever necessary, family members will also have to be screened and tested for possible tuberculosis infection.

To address recurring infections resulting from patients neglecting to take their prescribed medicines on time, a barangay health program has been established. Under this program, patients are required to report to their designated BHW every day. The BHW will responsible for overseeing and administering the patient's medication intake.

Thus, it can be said that the effectiveness of the tuberculosis control program may be fully attributed to the adequate supply of tuberculosis medicines, the availability of sputum smear tests, gene-expert and PPD tests, and the effort of the BHWs in the supervision of proper intake of medicines.

In general, the PHC service in terms of tuberculosis control program is considered effective as shown from the composite mean of 2.83. The success of this program is evident in the 101% tuberculosis case detection rate and 93% tuberculosis success rate reached by the Batangas Province in 2015 [80]. This finding is congruent to the findings of [90] where participants perceived the PHC program focused on tuberculosis treatment delivery as good. Both studies show that the success in the tuberculosis control program is founded on the hard work of health care workers and the successful implementation of directly observed treatment strategy.

However, the findings of this study differ from another research conducted in rural areas of Indonesia, which aimed to describe the effectiveness of a tuberculosis control program. The latter study indicated that the implementation of the pulmonary tuberculosis control program in that context had not been effective [91]. The lack of synergy can be attributed to the low level of public awareness, making it difficult for individuals to adhere to their treatment consistently. Additionally, there is a deficiency in monitoring and evaluating the performance of health workers.

Table 10. Effectiveness of PHC services in terms of control of acute respiratory infection

Indicators	Weighted mean	Verbal interpretation	Rank
(i) Case finding: identification of patient with acute respiratory infection among 0–4 years old and management and treatment of patients identified with acute respiratory infection.	2.65	Effective	2
(ii) Promoting health education of mothers and caretakers of 0–5 years old through household teaching and bench conferences	2.69	Effective	1
Composite mean	2.67	Effective	

Note:3.50–4.00 = Highly effective; 2.50–3.49 = Effective; 1.50–2.49 = Less effective; 1.00–1.49 = Not effective

Based on **Table 10**, the program focused on controlling acute respiratory infection cases was deemed effective, with a composite mean score of 2.67. All components were rated positively, with the highest effectiveness observed in health education for mothers and caretakers of children aged 0–5 years through household teaching and bench conferences, scoring 2.69. This was followed by case finding, which involved identifying patients with acute respiratory infections among those aged 0–4 years and managing and treating them, with a mean score of 2.65.

The household teaching methodology and bench conferences were found effective because in these

activities, the mothers learned about the importance of early detection of respiratory tract infection in children between 0 and 5 years old in preventing its development into acute pneumonia. During these activities, mothers or caregivers received guidance on various aspects, including how to identify acute respiratory infections, the responsible intake of antibiotics, and the importance of monitoring oxygen levels and intensity of care.

This finding bears a resemblance to a study in which it was established that children displaying symptoms of acute respiratory infections in an urban community in the Philippines often engaged in self-treatment with antibiotics like amoxicillin, as well as its derivatives cotrimoxazole and cephalosporins. These bench conferences and household discussions not only raised awareness about acute respiratory infections but also enhanced understanding of them. Mothers and caregivers were encouraged to refrain from self-medication practices, which often resulted in the misuse of antibiotics. As a result, respondents perceived this activity as effective [92].

The implementation of case finding was also perceived to be effective. According to the BNS of Buli in Taal and Dulungan in San Luis, these case findings were done simultaneously during the implementation of Oplan Timbang. During Oplan Timbang and immunization schedules, the BNS observed children aged 0 to 5 years for symptoms indicative of acute respiratory infections.

This discovery aligns with a study highlighting that community-based active case-finding (ACF) can have significant effects on the routine detection of respiratory pathogens. This approach indirectly contributes to disease prevention and care [93].

Table 11. Effectiveness of PHC in terms of diarrheal disease program

	Indicators	Weighted mean	Verbal interpretation	Rank
(i)	Health education: promotion of proper environmental sanitation and importance of oral rehydration solution (ORS) in cholera and diarrheal disease (CDD)	2.54	Effective	1
(ii)	Provision of adequate supply of Oresol	2.16	Less effective	2
	Composite mean	2.35	Less effective	

Note:3.50–4.00 = Highly effective; 2.50–3.49 = Effective; 1.50–2.49 = Less effective; 1.00–1.49 = Not effective

Table 11 displays the evaluation of the effectiveness of the diarrheal disease program, which is generally perceived as less effective. Among the listed items, health education involving the promotion of proper environmental sanitation and emphasizing the importance of ORS in CDD was found to be effective. This finding is due to the fact that the respondents are aware that their LGUs are promoting environmental sanitation to avoid diarrhea. During bench conferences or dialogues held in the barangays to promote environmental sanitation, including water and food safety, the importance of clean food and water sources is emphasized as a means to prevent diarrhea. Additionally, rural health midwives and BHWs consistently explain to the barangay authorities the significance of oral rehydration salts in controlling diarrheal diseases.

CDD was implemented by the DOH in 1997 centered on the prevention, management and treatment of diarrhea among children under five years of age.

Since the finding is hinged on the effective promotion of proper environmental sanitation and importance of ORS in CDD, it implies that mothers or caretakers in Batangas are aware of the importance of clean surroundings and ORS in the prevention and treatment of diarrhea.

However, provision of adequate supply of oresol has proven to be less effective based on the actual observations made. It obtained the lowest mean value of 2.16. This may be due to the fact that ORS is not always available in the Barangay Health Centers or Stations. According to the respondents, when one or

two of their family members suffer from diarrhea, they had to buy ORS from the nearest pharmacy because their respective BHSs are out of stock. They further stated that stocks are only provided by the RHU during community outbreaks of diarrhea. Given that the respondents come from third to fifth-class municipalities, most of them, with the exception of Dulungan in San Luis and Buli in Taal, utilize their own barangay funds to procure medicine supplies. This is because they still rely on support from the provincial or municipal government. Consequently, the availability of ORS in the BHS is either limited or non-existent.

The inadequate supply of ORS in the country is one of the main reasons why the use of ORS has become limited. The two indicators in relation to each other, does not translate to its effective use because of the limited access. Another finding is also presented in a study where it was debated that "a high knowledge of ORS (nearly 90%) does not translate to its subsequent usage [94]," a contributory factor directly affecting access to ORS in the country) [95].

Table 12. Effectiveness of PHC services in terms of cardiovascular disease prevention and control program

	Indicators	Weighted mean	Verbal interpretation	Rank
(i)	Case finding: conducting blood pressure screening for individuals aged 15 years old and above, especially those with a family history of hypertension.	2.63	Effective	2.5
(ii)	Promotion of healthy lifestyle through physical activity and exercise, healthy diet, weight control, stress management and emphasized smoking cessation	2.63	Effective	2.5
(iii)	Treatment: giving anti-hypertensive drugs	2.64	Effective	1
	Composite mean	2.64	Effective	

Note: 3.50–4.00 = Highly effective; 2.50–3.49 = Effective; 1.50–2.49 = Less effective; 1.00–1.49 = Not effective

Table 12 presents the evaluation of the cardiovascular disease prevention and control program. Under the treatment category, providing anti-hypertensive drugs received the highest mean score of 2.64. Respondents mentioned that they obtain anti-hypertensive drugs from their BHSs, even though the supply may not always meet their full needs. They found this assistance to be greatly beneficial. Some of the hypertensive drugs they mentioned receiving from barangay health stations include losartan and amlodipine.

It must be noted that from the respondent-barangays, only Buli and Dulungan have purchased their medicines from their own barangay fiscal budget. The rest relied on their respective RHUs and the medicine supply from the Provincial Government.

However, case finding, which involves conducting blood pressure screenings for individuals aged 15 years and above, especially those with a family history of hypertension, along with the promotion of a healthy lifestyle through physical activity and exercise, maintaining a healthy diet, weight control, stress management, and emphasizing smoking cessation, received the lowest rating. Despite this, they were still considered effective.

The respondents noted that while they perceived blood pressure screenings among individuals aged 15 years and older as essential, none of their family members had actually undergone such screenings. Instead, they mentioned that they only undergo medical screenings or examinations when they experience symptoms. They also expressed that their BHSs or RHUs were accommodating when they sought such medical attention. They considered these facilities effective because they could visit them when feeling unwell to have their blood pressure checked.

The respondents perceived the promotion of healthy lifestyle through physical activity and exercise, healthy diet, weight control, stress management and, emphasized smoking cessation as effective. This is

because BHSs have created HPN/DM clubs under the order of DOH, where patients with hypertension and diabetes mellitus gather once a week. A Municipal Nurse would educate them on importance of healthy diet and lifestyle, and every session would end with Zumba class or aerobics. Active members entitled to free maintenance drugs for hypertension (losartan/amlodipine/metoprolol) and diabetes (metformin) from the DOH.

With a composite mean rating of 2.64, it can be concluded that primary healthcare services in terms of cardiovascular disease prevention and control program are effective in Batangas. This observation aligns with findings that emphasize the utility of cardiovascular disease programs in providing valuable information for the prevention and control of cardiovascular diseases in the region.

Table 13. Effectiveness of PHC services in terms of dental health program

	Indicators	Weighted mean	Verbal interpretation	Rank
(i)	Conducting oral examinations on pregnant mothers, preschoolers, schoolers and adult	2.55	Effective	1.5
(ii)	Offering preventive measures: sealant application for school children and oral prophylaxia for pregnant and school children	2.51	Effective	3
(iii)	Curative measures: gum treatment, temporary filling, permanent filling and extraction.	2.55	Effective	1.5
(iv)	Conduct of dental mission in remote areas	2.48	Less effective	4
	Composite mean	2.52	Effective	

Note: 3.50–4.00 = Highly effective; 2.50–3.49 = Effective; 1.50–2.49 = Less effective; 1.00–1.49 = Not effective

Table 13 shows the effectiveness of dental health program. A composite mean of 2.52 indicates that the program is effective in general. Both conducting oral examinations for pregnant mothers, preschoolers, school-aged children, and adults, as well as providing curative measures such as gum treatment, temporary filling, permanent filling, and extractions, received an identical mean score of 2.55. This may be attributed to the presence of a Municipal Dentist who conducts oral examinations and the numerous dental missions conducted by the Provincial Health Office and other agencies. For example, in Dita, Cuenca, dental missions were carried out by the military, according to the respondents. One respondent also said that there are numerous dental associations who conduct dental missions in schools.

In terms of adult and curative measures, the residents of Dita in Cuenca and Kalayaan in Sta. Teresita rely on the free dental services of the Municipality of San Luis. The free dental services are only for tooth extraction, so they have to go to private clinics for gum treatment and temporary and permanent filling. This is analogous to the findings that among the rural population all health services are given free, except for major operations, medicines and dental procedures such as the construction of partial and full dentures, porcelain restorations, root canal therapy and major oral surgery [96].

Meanwhile, with a mean of 2.48, conduct of dental mission in remote areas was perceived as less effective. Remote barangays such as Balibago in Lobo, Batangas experience very few dental missions. This perception may also be due to the fact that many dental missions have been cancelled during the COVID-19 pandemic. It was reiterated the call for more dental missions to remote barangays. According to studies, dentistry is one of the most underserved healthcare services worldwide, which is essentially true for remote and impoverished communities [96]. The finding of this study may imply that many of the residents in distant and remote areas from Batangas may have never seen a dentist before.

Table 14. Effectiveness of PHC services in terms of rabies control program

	Indicators	Weighted mean	Verbal interpretation	Rank
(i)	Information identification and communication: increasing the community's awareness regarding rabies prevention and control through community assemblies, bench. conferences, and household teachings	2.62	Effective	2.5
(ii)	Tetanus prevention: providing tetanus toxoid and anti-tetanus serum injection.	2.59	Effective	4
(iii)	Referrals: All patients with animal bites categorized as CAT II and CAT III are referred for anti-rabies immunization.	2.62	Effective	2.5
(iv)	Coordination: Coordinating with the Department of Agriculture for vaccination of dogs.	2.94	Effective	1
	Composite mean	2.69	Effective	

Note: 3.50–4.00 = Highly effective; 2.50–3.49 = Effective; 1.50–2.49 = Less effective; 1.00–1.49 = Not effective

Table 14 shows the assessment of the respondent on the effectiveness of rabies control program. "Coordination: Coordinate with the Department of Agriculture for vaccination of dogs" received the highest rating of 2.94. The effective perception of the respondents may be attributed to the free dog and cat vaccinations that are given annually by the barangay, which the respondents have greatly benefited from.

The second-ranking components, each with a mean rating of 2.5, include information identification and communication, which involves increasing community awareness of rabies prevention and control through community assemblies, bench conferences, and household teachings. Additionally, referrals, which involves ensuring that all patients with animal bites categorized as CAT II and CAT III are referred for anti-rabies immunization, was also rate effective.

These findings suggest that the local government, through the Municipal Agriculture Office, has been successful in its information and awareness campaign against rabies. All respondents are well-informed about the dangers posed by rabies and the importance of vaccinating their pets against it. Moreover, they believe that the government effectively refers animal bite patients for anti-rabies immunization, although the accessibility of such services varies across municipalities in the province. For instance, in Dita, there are no available animal bite centers, necessitating patients to seek immunization from private institutions or the Municipality of San Luis. Similarly, San Nicolas, Sta. Teresita, and Alitagtag rely on the healthcare facilities of San Luis for anti-rabies immunization.

The least rated item was tetanus prevention, which involves giving tetanus toxoid and anti-rabies serum injection. Though the respondents find the tetanus prevention effective, it was the least ranked because of its high cost. Though it is available everywhere, it is never free in the province of Batangas. While the administration of the vaccine is free, the vaccine is not free. In fact, it is more expensive in government hospitals. However, there are several instances where the RHUs would provide free tetanus toxoid to fishermen and other vulnerable groups such as pregnant women.

A composite mean of 2.68 indicated that the program is effective in general. It is parallel to the findings where information dissemination on rabies awareness was found to have immense importance in the effective control of rabies and that vaccination of dogs and cats was an effective preventive measure [99].

Table 15. Effectiveness of PHC services in terms of STD/AIDS prevention Program

Indicators	Weighted mean	Verbal interpretation	Rank
(i) Lecture/Symposium: providing health education and IEC materials to high schools and barangays, especially commercial sex workers (CSWs) and bar owners.	2.59	Effective	1
(ii) Gram staining: Conducting monthly vaginal smearing and gram staining among CSWs and conducting HIV testing.	2.49	Less effective	3
(iii) Treatment: giving medications to those with positive gram stain and inflammation.	2.51	Effective	2
(iv) Presence of laboratory capability.	2.17	Less effective	4
Composite mean	2.44	Less effective	

Note: 3.50–4.00 = Highly effective; 2.50–3.49 = Effective; 1.50–2.49 = Less effective; 1.00–1.49 = Not effective

Table 15 displays the assessment on the STD/AIDS program. providing health education and IEC materials to various high schools and barangays, especially targeting commercial sex workers and bar owners through lectures and symposia, received the highest mean score of 3.59, signifying its effectiveness. This implies that the lectures and symposiums conducted on schools by NGOs and barangays by the RHU are effective on providing education and awareness on STD and AIDS. The lectures given to commercial sex workers and bar owners is deemed to be effective in raising their awareness of the risks of contracting these diseases, especially in their line of profession. It must be noted that according to the 12 respondent-barangays, none of them have been positive for STD/HIV/AIDS, which suggest the effective impact of these lectures and symposiums.

However, the treatment or giving medications to those with positive gram stain and with inflammation was assessed as effective with a mean of 2.51. This finding is surprising as there have been no records of positive cases in the respondent-barangays, yet they assessed the treatment as effective. This finding is founded on the confidence of the respondents that if one ever contracts the disease, the government will help them with the medications.

While, "gram staining: monthly vaginal smearing and gram staining among CSWs and HIV testing" and "presence of laboratory capability" were less effective. This finding can be credited to the confidentiality of gram staining conducted by the RHUs on CSWs, in addition to the temporarily discontinuing of this program due to the pandemic. As such, most of the respondents find it less effective. In addition, there are currently no government laboratory that provides free HIV testing in the province, which is why the respondents find it less effective.

As seen from the composite mean, the PHC services in terms of STD/AIDS prevention program were less effective. This finding contradicts published studies where STD/AIDS prevention programs were found to be effective [100], especially activities like providing non-formal educational training such as lectures/symposiums for target high-risk groups such as female sex workers and their establishment managers. This also diverges from the conclusion that government has reach its over-all goal in the STD/AIDS prevention and control [101].

Table 16. Effectiveness of PHC in terms of cancer prevention and control program

Indicators	Weighted mean	Verbal interpretation	Rank
(i) Health education: conducting household teachings	2.63	Effective	1
(ii) Pap smearing for women of 25–55 years old, and visual inspection with acetic acid for women of 21–65 years old women	2.59	Effective	2
(iii) Conducting breast exam among women of 30–55 years old.	2.48	Less effective	3
Composite mean	2.57	Effective	

Note: 3.50–4.00 = Highly effective; 2.50–3.49 = Effective; 1.50–2.49 = Less effective; 1.00–1.49 = Not effective

Table 16 shows the effectiveness of cancer prevention and control program. Health education through conducting household teachings got the highest mean score of 2.63, and it is considered effective. This indicates that the respondents find the household teachings conducted by rural health officers effective. They learn about symptoms and importance of early detection from these teachings.

Similarly, with a mean score of 2.59, the respondents considered the conduct of pap smearing for women aged 25–55 years and visual inspection with acetic acid for women aged 21-65 years as effective. It is worth noting that cervical cancer is the second most common cancer among women in the Philippines, accounting for 14% of female cancers and ranking as the second leading cause of cancer mortality. Despite temporary interruptions during the COVID-19 pandemic, the availability of free pap smears and visual inspections for women was highly appreciated by the respondents. These screenings offer women the opportunity to access free cervical screening, potentially saving them from cervical cancer in the future.

On the other hand, the conduct of breast exam among 30–55 years old women was perceived as less effective. This is because most of the respondents stated that they are not well-informed that a breast exam was available in the rural health centers. Some individuals expressed reluctance to avail of the program due to concerns about the possibility of the doctor discovering a lump during breast examinations. Others were uncomfortable with the idea of having their breasts examined.

It must be noted though that the same respondents who found the breast exam less effective found the pap smear effective. When asked about this, most of the respondents stated that pap smear was a clinical test while breast exam is a physical test, and they believe more in clinical tests.

With a general mean of 2.57, the cancer prevention and control program was perceived as effective. This is in agreement with the idea that for years, PHC has played a vital role in promoting health and reducing the incidence of and mortality from cancer through early diagnosis [102]. PHC plays a vital role in raising public awareness about the significance of screening, particularly among high-risk patient groups. This is essential in ensuring that any concerning symptoms are promptly assessed and appropriate action and medication are initiated as soon as possible.

Table 17. Effectiveness of PHC in terms of leprosy control program and health education

Indicators	Weighted mean	Verbal interpretation	Rank
(i) Conducting community assemblies, bench conferences, and household teaching for early detection and treatment;	2.58	Effective	1
(ii) Coordinating with the Provincial Health Office for the provision of complete medication.	2.57	Effective	2
Composite mean	2.57	Effective	

Note: 3.50–4.00 = Highly effective; 2.50–3.49 = Effective; 1.50–2.49 = Less effective; 1.00–1.49 = Not effective

Table 17 displays the assessment of leprosy control program and health education. Both items in this category were assessed as effective. Conducting community assemblies, bench conferences, and household teaching for early detection and treatment ranked first with mean score of 2.58 followed by coordinating with the Provincial Health Office for the provision of complete medication.

The effectiveness of the leprosy control program is evident as all of the barangay respondents reported zero leprosy cases up to the present. This indicates that the government is successful in preventing leprosy through early detection, and there are established mechanisms in place to address any potential cases by simply reporting them to the Provincial Health Office.

The awareness of the respondents on the leprosy control programs of the government is in disparity with

the findings where respondents were only moderately aware and only moderately accepts the government policies, programs, and projects on health service for leprosy [103]. On the present study, however, there have been no personal experience yet they are fully aware and believes in the effectiveness of the primary health care services in terms of leprosy.

Table 17. Effectiveness of PHC in terms of health education and health promotion

Indicators	Weighted mean	Verbal interpretation
Promotion of health through advocacy, community assembly, bench conference, mothers' class and household teaching	2.57	Effective

Note:3.50–4.00 = Highly effective; 2.50–3.49 = Effective; 1.50–2.49 = Less effective; 1.00–1.49 = Not effective

Table 18 reveals that the health education and health promotion program was effective, with a mean of 2.57, which concentrate on the promotion of health thru advocacy, community assembly, bench conference, mothers' class, and household teaching.

Community assemblies, such as State of Barangay Address conducted twice a year, bench conferences, mother's class such as Usapang Buntis, and household teaching, were deemed effective in raising awareness and promoting health. These activities are done locally and sometimes in conjunction with one another. Although community assemblies were forbidden during the pandemic, the RHUs and BHSs continued to promote the health of the residents during small discussion or household teachings during immunization schedules of infants or Oplan Timbang. Thus, the respondents were still in full awareness of all the advocacies of the government in terms of promotion of health and find them effective.

The importance of promoting health in the PHC services is also evident in the study where effective understanding and delivery of health promotion practice brings improved health status of the general population [104].

Table 19. Effectiveness of PHC services in terms of voluntary blood donation program

Indicators	Weighted mean	Verbal interpretation	Rank
(i) Information dissemination: community assembly, tri-media campaign, and public forum.	2.63	Effective	3
(ii) Identifying possible donors: master listing and blood typing.	2.66	Effective	2
(iii) Bloodletting: bloodletting of all qualified and properly screened donors.	2.77	Effective	1
Composite mean	2.68	Effective	

Note: 3.50–4.00 = Highly effective; 2.50–3.49 = Effective; 1.50–2.49 = Less effective; 1.00–1.49 = Not effective

Table 18 illustrates that all components of the voluntary blood donation program were considered effective. The highest-rated item was "Blood Letting," which involves conducting bloodletting from all qualified and properly screened donors, with a mean rating of 2.77. Following closely were "Identifying possible donors: master listing and blood typing," both of which were also rated as effective.

The organization of bloodletting through Red Cross and district hospitals in conjunction with master listing and blood typing have been rated effective by the respondents. This is because the respondents are familiar with bloodletting. During the Bloodletting Month, which is July, the extensive campaign for donating blood is cascaded to the barangay. Besides, BHWs conducts house to house invitation to probable donors and encourage the residents to donate blood. In every barangay, there is a master list of probable blood donors, known as

Barangay-based Voluntary Blood Donors Registry, and the potential donors will be called when the need arises.

With a composite mean rating of 2.68, it can be concluded that the voluntary blood donation program is effective. This finding is consistent with a recent study conducted in Manila, Philippines, which concluded that voluntary blood donation programs, including regular blood donation activities and campaigns, significantly contribute to increasing blood donation rates [105].

Table 20. Summary of the effectiveness of PHC services

Indicators	Weighted mean	Verbal interpretation	Rank
Maternal and child health program	2.77	Effective	3
EPI	2.82	Effective	2
Tuberculosis control program	2.83	Effective	1
Nutrition program	2.74	Effective	4
Control of acute respiratory infection	2.67	Effective	8
Environmental sanitation	2.67	Effective	9
Diarrheal disease program	2.35	Less effective	17
Cardiovascular disease prevention and control program	2.64	Effective	10
Dental health program	2.52	Effective	15
Reproductive health and family planning program	2.68	Effective	6
Voluntary blood donation program	2.68	Effective	6
Rabies control program	2.69	Effective	5
STD/AIDS prevention program	2.44	Less effective	16
Cancer prevention and control program	2.57	Effective	13
Leprosy control program and health education	2.57	Effective	11
Circumcision program	2.52	Effective	14
Health education and health promotion	2.57	Effective	12
Composite mean	2.57	Effective	

Note: 3.50–4.00 = Highly effective; 2.50–3.49 = Effective; 1.50–2.49 = Less effective; 1.00–1.49 = Not effective

Table 20 illustrates the summary on the effectiveness of primary health care services. A composite mean of 2.57 indicates that the program was effective in general. However, upon scrutiny of result, it was found out that tuberculosis control program, EPI, and maternal and child health program got the highest mean score of 2.83, 2.82, and 2.77, respectively. This is not surprising as the Provincial Health Office recorded 101% success in terms of detection rate.

Meanwhile, STD/AIDS prevention program and diarrheal disease program were assessed as less effective. This finding may be attributed to the lack of laboratory capacity for STD/HIV free testing in the province. Also, the restrictions of COVID-19 have put a toll on the monthly conduct of gram staining and vaginal smearing for commercial sex workers.

On the same note, the lack of ORS on BHSs has also affected the perception towards the diarrheal disease program. It must be noted that even if there are supplies from the RHUs, the BHSs are nearer to the residents. When there is none at the BHS, the respondents would rather buy from near pharmacies than to travel to the RHUs.

Table 21. Difference of responses on the effectiveness of PHC services when grouped according to age

Age	λ^2_c/U	*P-value*	Interpretation
Maternal and child health program	11.138	0.049	Significant
EPI	15.436	0.009	Significant
Tuberculosis control program	12.129	0.033	Significant
Nutrition program	17.066	0.004	Significant
Control of acute respiratory infection	12.277	0.031	Significant
Environmental sanitation	11.223	0.047	Significant
Diarrheal disease program	10.572	0.061	Not significant
Cardiovascular disease prevention and control program	11.498	0.042	Significant
Dental health program	12.836	0.025	Significant
Reproductive health and family planning program	15.36	0.009	Significant
Voluntary blood donation program	17.193	0.004	Significant
Rabies control program	14.316	0.014	Significant
STD/AIDS prevention program	13.213	0.021	Significant
Cancer prevention and control program	15.206	0.010	Significant
Leprosy control program and health education	14.307	0.014	Significant
Circumcision program	15.628	0.008	Significant
Health education and health promotion	15.442	0.009	Significant

Table 21 presents the comparison of responses on the effectiveness of PHC services when grouped according to profile. It was observed that there was significant difference except on diarrheal disease program when grouped according to sex and control of acute respiratory infection, reproductive health and family planning program, and rabies control program when grouped according to sex. This was indicated by the *P-values*, which were less than the α level, which implies that the responses differ significantly. Based on a post-hoc test conducted, it was found that those females who are 51 years old and above, whom were high school graduates and from Buli were more likely to perceive the programs as effective.

The difference in responses on the effectiveness of PHC services when grouped according to age is also evident in the where higher ratings of PHC were associated with the increase in age [106].

Table 22. Difference of responses on the effectiveness of PHC services when grouped according to sex

	λ^2_c/U	*P-value*	Interpretation
Maternal and child health program	15888	0.004	Significant
EPI	15987	0.005	Significant
Tuberculosis control program	16206.5	0.008	Significant
Nutrition program	15806	0.003	Significant
Control of acute respiratory infection	17132.5	0.062	Not Significant
Environmental sanitation	15948	0.004	Significant
Diarrheal disease program	15585.5	0.001	Significant
Cardiovascular disease prevention and control program	16106	0.006	Significant

Table 22 (continued)

	λ^2_c/U	*P*-value	Interpretation
Dental health program	16449	0.015	Significant
Reproductive health and family planning program	17240	0.081	Not significant
Voluntary blood donation program	15591	0.001	Significant
Rabies control program	17527.5	0.142	Not significant
STD/AIDS prevention program	15939	0.004	Significant
Cancer prevention and control program	16389	0.012	Significant
Leprosy control program and health education	15414	0.001	Significant
Circumcision program	16478	0.012	Significant
Health education and health promotion	16456	0.011	Significant

Table 22 presents the comparison of responses on the effectiveness of PHC services when grouped according to sex. It was observed that there was significant difference on all PHC programs except control of acute respiratory infection, reproductive health and family planning program and rabies control program when grouped according to sex. This was indicated by the P-values, which were less than the α level, which implies that the responses differ significantly. Based on the post-hoc test conducted, it was found out that females were more likely to assess the program as more effective than males.

A significant difference was observed in the assessment of the maternal and child health program between males and females, with females perceiving it as more effective than males. This may be due to the fact that the maternal and child health programs benefits females than males, so they are more favored by the females.

The disparity in the assessment of the EPI can be attributed to the fact females usually the ones bringing their children to BHS for immunizations. Consequently, they tend to be more knowledgeable about and favorable toward the program.

In terms of other programs, more females find the programs more favorable than males simply because they are more aware and knowledgeable of them.

This pattern can be attributed to the fact that mothers or eldest daughters often take on the role of caregivers within the family. They are more likely to attend conferences, lectures, and other health programs compared to males, leading to their greater familiarity and positive perception of these programs.

Table 23. Difference of responses on the effectiveness of PHC services when grouped according to educational attainment

	λ^2_c / U	*P-value*	Interpretation
Maternal and child health program	15.001	0.010	Significant
EPI	13.843	0.017	Significant
Tuberculosis control program	13.047	0.023	Significant
Nutrition program	13.67	0.018	Significant
Control of acute respiratory infection	12.984	0.024	Significant
Environmental sanitation	19.685	0.001	Significant
Diarrheal disease program	14.711	0.012	Significant
Cardiovascular disease prevention and control program	17.463	0.004	Significant
Dental health program	18.351	0.003	Significant

Table 23 (continued)

	λ^2_c / U	*P-value*	Interpretation
Reproductive health and family planning program	17.114	0.004	Significant
Voluntary blood donation program	14.101	0.015	Significant
Rabies control program	17.873	0.003	Significant
Std / aids prevention program	20.755	0.001	Significant
Cancer prevention and control program	15.36	0.009	Significant
Leprosy control program and health education	12.911	0.024	Significant
Circumcision program	13.457	0.019	Significant
Health education and health promotion	18.21	0.003	Significant
Maternal and child health program	15.001	0.010	Significant

Table 23 presents the comparison of responses on the effectiveness of primary health care services when grouped according to educational attainment. It was observed that there was significant difference on all primary health programs when grouped according to educational attainment. This was indicated by the *P-values*, which were less than the α level, which implies that the responses differ significantly. Based on the post-hoc test conducted, it was found out that respondents belong to the category of high school graduate assessed the programs more effective.

This finding may be attributed to the fact that high school graduates are more reliant on government free health services than college graduates who are more learned and are more aware and capable to avail of more options. A number of respondents who are college graduates stated that they prefer to consult private doctors for check-ups and immunization of their children than queuing up in the BHSs. They also prefer to buy branded medicines than those available in BHS.

Table 24. Difference of responses on the effectiveness of primary health care services when grouped according to barangay

	λ^2_c/U	*P-value*	Interpretation
Maternal and child health program	160.169	0.000	Highly significant
EPI	143.515	0.000	Highly significant
Tuberculosis control program	153.363	0.000	Highly significant
Nutrition program	165.424	0.000	Highly significant
Control of acute respiratory infection	136.9	0.000	Highly significant
Environmental sanitation	144.522	0.000	Highly significant
Diarrheal disease program	107.658	0.000	Highly significant
Cardiovascular disease prevention and control program	145.256	0.000	Highly significant
Dental health program	147.349	0.000	Highly significant
Reproductive health and family planning program	131.365	0.000	Highly significant
Voluntary blood donation program	135.192	0.000	Highly significant
Rabies control program	146.97	0.000	Highly significant
STD/AIDS prevention program	140.62	0.000	Highly significant
Cancer prevention and control program	144.496	0.000	Highly significant

Table 24 (continued)

	λ^2_c/U	*P-value*	Interpretation
Leprosy control program and health education	149.927	0.000	Highly significant
Circumcision program	131.046	0.000	Highly significant
Health education and health promotion	128.86	0.000	Highly significant

Table 24 indicates that there is a highly significant difference in the assessment of primary health care services when grouped according to sex. This significant difference is evident as the computed *P-values* were lower than the α level, signifying a highly significant variation in responses between the two groups. Additionally, the post hoc test revealed that respondents from Buli assessed the programs as more effective.

This finding is not surprising because when compared with other barangay-respondents, Buli is more capable of providing PHC services. hey have active Barangay Health Stations (BHSs), allocate funds for purchasing hypertensive drugs, possess logistics like Barangay Patrols and other vehicles, and their municipality, Taal, is currently expanding its RHU to include maternity beds. These capabilities and resources in Buli may explain why its residents assessed all primary health care services and programs as more effective compared to other barangays included in the study.

However, this is quite surprising because Dulungan in San Luis has more capability than Buli. Dulungan has an existing ambulance, also has allocated budget to finance their residents' hypertensive drugs and their municipality, San Luis, already has free anti-rabies vaccines, free facilities for birthing, free dental procedures and upgraded RHU that their municipality won the 2018 Best Local Performing LGU awarded by the DOH.

Based on the respondents' assessment, the researcher formulated an action plan that may be used by the Province of Batangas to further address and enhance the primary health care services/programs that received a less effective assessment (**Table 25**).

Table 25. Proposed action plan to enhance the primary health care programs in Batangas

Programs/ Plans/Activities	Strategy	Performance Indicator	Office Responsible
Provision of facility-based delivery	Coordinate with the Provincial Government and DBM to source out fundings for the creation of free birthing institutions in each municipality	Birthing facilities that will provide free and safe deliveries for the residents in every municipality.	Office of the Governor, Sangguniang Panlalawigan, DBM, LGUs, DOH
Purchase of adequate supply of Oresol	(i) Coordinate with Provincial Health Office to ensure that all BHSs will be provided with Oresol. (ii) Disseminate information about the supply of Oresol from RHUs	(i) Adequate supply of Oresol in each barangay (ii) Residents are informed on the availability of Oresol (iii) Improved control of diarrheal disease	Provincial Health Office, Office of the Governor, Sangguniang Panlalawigan, LGUs, DOH, RHUs
Conduct of dental mission in remote areas	Coordinate with the Provincial Health Office, Philippine Dental Association (PDA) and other organizations for requests of dental mission to remote barangays in the province.	Batanguenos have better oral health.	Provincial Health Office, LGUs, DOH, RHUs, PDA, NGOs
Re-implementation of the monthly vaginal smearing and gram staining among CSWs and HIV testing	(i) Coordinate with the Provincial Health Office and the LGUs to re-implement the monthly vaginal mearing, gram staining and HIV testing to CSWs. (ii) Suspend the business permits of bars who do not comply with the scheduled gram staining	CSWs in Batangas are clinically tested to be HIV-free.	Provincial Health Office, LGUs, DOH, RHUs, BPLO

Table 25 (continued)

Programs/ Plans/Activities	Strategy	Performance Indicator	Office Responsible
Establishment of free HIV testing centers	(i) Coordinate with the Office of the Governor and Provincial Health Officer to create at least one HIV testing facility in the province. (ii) Coordinate with DOH and NGOs such as AHF and Loveyourself Inc. on building a free and confidential HIV testing facility in the province.	(i) Batanguenos have access to free and confidential HIV testing center. (ii) Improved STD/AIDS prevention program.	Office of the Governor, Provincial Health Office, DOH, NGOs, Sangguniang Panlalawigan
Information and education campaign on the importance of breast examinations for women of 30–55 years old	(i) Coordinate with the Provincial Health Office, Provincial Information Office, LGUs, RHUs, Barangays to conduct a provincial-wide IEC on the importance of breast examinations. (ii) Coordinate with provincial/city/municipal social welfare organizations and Development Office to include breast examinations in check-ups of mothers who are 4Ps beneficiaries	(i) Batanguenos are aware and knowledgeable on the importance of having their breasts examined as cancer prevention. (ii) 4Ps members are encouraged to undergo breast examinations	Provincial Health Office, Provincial Information Office, LGUs, RHUs, P/C/MSWDO, barangays
Establishment of traditional medicine units in RHUs and district hospitals	(i) Institutionalize and enhance the provision of traditional medicine in health facilities by establishing units in DOH hospitals. (ii) Enhance knowledge of RHUs and Barangay Health Centers' knowledge on traditional medicine.	Each district hospital and RHU will have a Traditional Medicine Unit	DOH, Office of the Provincial Governor, Provincial Health Office, LGUs, RHUs, barangays

6. Conclusions

The respondents are 40 to 50 years of age, female, high school graduates and majority are from Buli.

(i) The PHC service in the Batangas Province is effective in terms of maternal and child health program, EPI, tuberculosis control program, nutrition program, control of acute respiratory infection, environmental sanitation, cardiovascular disease prevention and control program, dental health program, reproductive health and family planning program, voluntary blood donation program, rabies control program, cancer prevention and control program, leprosy control program and health education, circumcision program, health education and health promotion. However, diarrheal disease program and STD/AIDS prevention program are less effective.

(ii) There is significant difference on the assessment of the effectiveness of PHC services when grouped according to the profile of the respondents. In terms of age, respondents who are 51 years old and above were more positive on the effectiveness of primary health care services except for the diarrheal disease program.

(iii) In terms of gender, female respondents generally perceive primary health care services as more effective than males, with the exception of the control for acute respiratory infection, reproductive health and family planning, and rabies control program. When considering educational attainment, a significant difference in responses regarding the effectiveness of all primary health care programs was observed. Lastly, when looking at the different barangays, respondents from Buli tend to rate all primary health care programs as more effective in the province of Batangas.

Therefore, an action plan to improve all health programs assessed to be less effective is proposed.

7. Recommendations

(i) The Provincial Health Office could consider seeking support from the Office of the Governor and NGOs to construct facilities that would enhance the delivery of health care services in the province.

(ii) The Provincial Health Office might request an increase in its allocated budget from the Office of the Governor and the Sangguniang Panlalawigan to ensure that there are sufficient supplies and logistical support, especially for third to fifth-class municipalities.

(iii) The Provincial Health Office could collaborate with the Provincial Information Office and utilize LGU social media platforms to raise public awareness about various health programs.

(iv) The proposed plan of action should be presented for discussion, with the intention of implementing and subsequently evaluating it in the future.

(v) Future researchers could explore similar research topics using different variables, specifically focusing on the delivery of PHC services.

Disclosure statement

The author declares no conflict of interest.

References

[1] World Health Organization, 2021, Primary Health Care, viewed September 21, 2022, https://www.who.int/news-room/fact-sheets/detail/primary-health-care

[2] Bautista V, 2001, Challenges to Sustaining Primary Health Care in the Philippines. Public Policy, 5(2): 89–127.

[3] Alzaied T, Alshammari A, 2016, An Evaluation of Primary Healthcare Centers (PHC) Services: The Views of Users. Health Science Journal, 10(2): 15.

[4] Philippine Statistics Authority, 2017, Highlights of the Philippine Population 2015 Census of Population, viewed September 21, 2022, https://rssocar.psa.gov.ph/population/highlights-2015-census-population-women-and-men

[5] Republic of the Philippines Department of Health, 2016, The Philippine Health Agenda 2016–2022, viewed August 23, 2022, https://ntp.doh.gov.ph/download/ao2016-0038/

[6] Province of Batangas, 2017, Rich Batangas: Gov. Dodo Talks About Health, Education, Livelihood in State of the Province Address, August 22, 2022, https://www.batangas.gov.ph/portal/state-of-the-province-address-2017/

[7] Angara E, 2010, An Act Establishing a Responsive Local Health Unit in Each City and Municipality to Ensure Delivery of Primary Health Services and to Provide a Mechanism to Ensure the Placement of Required Health Personnel in These Local Health Units and Other Government Operated Heath Facilities, Senate Bill No 2629, Fifteenth Congress, August 22, 2022, https://www.senate.gov.ph/lisdata/105479036!.pdf

[8] Zhang T, Shen X, Liu R, et al., 2021, The Impact of COVID-19 on Primary Health Care and Antibiotic Prescribing in Rural China: Qualitative Study. BMC Health Serv Res, 21(1): 1048. https://www.doi.org/10.1186/s12913-021-07082-z

[9] Lian, Batangas Profile, n.d., viewed August 18, 2022, https://www.philatlas.com/luzon/r04a/batangas/lian.html

[10] Fabon A, 2016, History of Buli, Taal, Batangas, SlideShare, viewed August 18, 2022, www.slideshare.net/barokz/history-of-buli-taal-batangas

[11] Buli, Taal, Batangas Profile, n.d., viewed August 18, 2022, https://www.philatlas.com/luzon/r04a/batangas/taal/buli.html

[12] Municipal Government of Tuy, n.d., viewed August 18, 2022, https://tuybatangas.gov.ph/

[13] San Luis, Batangas MIO, n.d., Home [Facebook page], viewed August 18, 2022, https://www.facebook.com/miosanluisbatangas/

[14] Lodi! DOH Hails Sam Ocampo as Top Performing Local Politiko in Calabarzon, 2018, Politiko, December 18, 2018, https://southluzon.politics.com.ph/2018/12/28/lodi-doh-hails-sam-ocampo-as-top-performing-local-politiko-in-calabarzon/

[15] Dulangan, San Luis, Batangas Profile, n.d., viewed August 18, 2022, https://www.philatlas.com/luzon/r04a/batangas/san-luis/dulangan.html

[16] Balibago, Lobo, Batangas Profile, n.d., viewed August 18, 2022, https://www.philatlas.com/luzon/r04a/batangas/lobo/balibago.html

[17] Coral na Munti, n.d., viewed August 18, 2022, https://www.agoncillo.gov.ph/government/barangays/coral-na-munti

[18] Coral na Munti, Agoncillo, Batangas Profile, n.d., viewed August 18, 2022, https://www.philatlas.com/luzon/r04a/batangas/agoncillo/coral-na-munti.html

[19] Poblacion West, Alitagtag, Batangas Profile, n.d., viewed August 18, 2022, https://www.philatlas.com/luzon/r04a/batangas/alitagtag/poblacion-west.html#:~:text=Poblacion%20West%20is%20a%20barangay,the%20total%20population%20of%20Alitagtag.

[20] Balete, Batangas, n.d., viewed August 18, 2022, https://www.baletebatangas.gov.ph/

[21] Phillipine Statistics Authority, 2021, Highlights of the Philippine Population 2020 Census of Population and Housing (2020 CPH), viewed August 18, 2022, https://psa.gov.ph/content/highlights-philippine-population-2020-census-population-and-housing-2020-cph

[22] Malabanan, Balete, Batangas Profile, n.d., viewed August 18, 2022, https://www.philatlas.com/luzon/r04a/batangas/balete/malabanan.html

[23] Dita, Cuenca, Batangas Profile, n.d., viewed August 18, 2022, https://www.philatlas.com/luzon/r04a/batangas/cuenca/dita.html

[24] Cities and Municipalities Competitiveness Index, n.d., viewed August 18, 2022, https://cmci.dti.gov.ph/

[25] District III, Mataas Na Kahoy, Batangas Profile, n.d., viewed August 18, 2022, https://www.philatlas.com/luzon/r04a/batangas/mataasnakahoy/district-iii.html

[26] BoyP Lakwatsa, San Nicolas, Batangas, 2017, Lakwatsa, viewed August 18, 2022, https://boyplakwatsa.com/2017/12/07/san-nicolas-batangas/

[27] San Nicolas, Batangas Profile, n.d., viewed August 18, 2022, www.philatlas.com/luzon/r04a/batangas/san-nicolas/poblacion.html

[28] Calayaan, Santa Teresita, Batangas Profile, n.d., viewed August 18, 2022, https://www.philatlas.com/luzon/r04a/batangas/santa-teresita/calayaan.html#:~:text=Calayaan%20Municipality%20of%20Santa%20Teresita%20Province%20of%20Batangas&text=Calayaan%20is%20a%20barangay%20in,total%20population%20of%20Santa%20Teresita

[29] Mackey S, Hatcher D, Happell B, et al., 2013, Primary Health Care as a Philosophical and Practical Framework for Nursing Education: Rhetoric or Reality?. Contemp Nurse, 45(1): 79–84.

[30] Azurin J, 1988, Primary Health Care: Innovations in the Philippine Health System 1981-1985. J. C. Azurin Foundation and Souvenir Publications, Makati.

[31] Papanikolaou V, Zygiaris S, 2014, Service Quality Perceptions in Primary Healthcare Centres in Greece. Health Expect 17(2): 197–207.

[32] Maisey S, Steel N, Marsh R, et al., 2008, Effects of Payment for Performance in Primary Care: Qualitative Interview Study. J Health Services Research Policy 13(3): 133–139.

[33] Papp R, Borbas I, Dobos E, et al., 2014, Perceptions of Quality in Primary Health Care: Perspectives of Patients and Professionals Based on Focus Group Discussions. BMC Fam Pract, 15: 128.

[34] World Health Organization, 1978, Report of the International Conference on Primary Health Care, September 6–12, 1978, USSR, Alma-Ata.

[35] World Health Organization, 2008, The World Health Report 2008: Primary Health Care – Now More than Ever, ReliefWeb, viewed August 22, 2022, https://reliefweb.int/report/world/world-health-report-2008-primary-health-care-now-more-ever

[36] Okpokoro E, 2013, Primary Health Care: A Necessity in Developing Countries? J Public Health Afr, 4(2): e17. https://doi.org/10.4081/jphia.2013.e17

[37] United Nations, 2013, The Millennium Development Goals, https://www.un.org/millenniumgoals/bkgd.shtml

[38] United Nations, 2015, Transforming our World: the 2030 Agenda for Sustainable Development, viewed August 22, 2022, https://sustainabledevelopment.un.org/post2015/transformingourworld/publication

[39] Gillam S, 2008, Is the Declaration of Alma Ata Still Relevant to primary health Care? BMJ, 336(7643): 536–538.

[40] Sepulveda MJ, Bodenheimer T, Grundy P, 2008, Primary Care: Can it Solve Employers' Health Care Dilemma?. Health Aff (Millwood), 27(1): 151–158.

[41] Batangan DB, 2015, Determinants of Resiliency in Primary Health Care Delivery in the Philippines, Ateneo de Manila University.

[42] UNICEF, 2020, Sanitation Targets are Off-Track: DOH, WHO and UNICEF Ask Local Governments to Invest in Sanitation, viewed August 22, 2022, https://www.unicef.org/philippines/press-releases/sanitation-targets-are-track-doh-who-and-unicef-ask-local-governments-invest

[43] World Health Organization, 2023, Tackling Environmental Health Challenges in the Philippines, viewed August 22, 2022, https://www.who.int/philippines/news/feature-stories/detail/tackling-environmental-health-challenges-in-the-philippines

[44] The World Bank, 2015, W*ater Supply and Sanitation in the Philippines: Turning Finance into Services for the Future,* viewed August 18, 2022, *http://documents1.worldbank.org/curated/en/469111467986375600/pdf/100894-WSP-P131116-AUTHOR-Susanna-Smets-Box393244B-PUBLIC-WSP-SERIES-WSP-Philippines-WSS-Turning-Finance-into-Service-for-the-Future.pdf*

[45] *Manasan R, 2018, Fiscal Sustainability, Equity, and Allocative Efficiency in the Light of the 2019 Supreme Court Ruling on the LGUs' Share in National Taxes, Philippine for Development Studies, viewed August 19, 2022, https://pidswebs.pids.gov.ph/CDN/PUBLICATIONS/pids dps2018.pdf*

[46] Bliss K, Nagpal T, 2021, Primary Health Care and Health Security, Center for Strategic & International Studies, viewed August 22, 2022, https://www.csis.org/analysis/wash-critical-component-primary-health-care-and-health-security

[47] Hutton G, Chase C, 2017, Water Supply, Sanitation, and Hygiene, in Injury Prevention and Environmental Health (3rd Edition), World Bank, Washington, DC.

[48] Mahler H, 1986, Prospects for Better Nutrition Through Primary Health Care, in Nutrition Issues in Developing Countries for the 1980s and 1990s: Proceedings of a Symposium, National Academies Press, Washington.

[49] Kraef C, Wood B, von Philipsborn P, et al., 2020, Primary Health Care and Nutrition. Bulletin of the World Health Organization, 98(12): 886–893.

[50] Solon F, 2000, Food Fortification in the Philippines: Policies, Programmes, Issues, and Prospects. Issues, and Prospects. Food and Nutrition Bulletin, 1(4): 515–520.

[51] Zabat P, 2014, Health Care Programs, Slideshare, viewed August 19, 2022, https://www.slideshare.net/lopao1024/health-care-programs

[52] National Nutrition Council, 2017, Laguna LGUs Share Best Practices and Strategies to Region I Local Nutrition Planners, viewed August 19, 2022, https://nnc.gov.ph/regional-offices/luzon/region-i-lupangilocos/2055-laguna-shares-best-nutrition-practices-and-strategies-in-nutrition-programs-to-region-i-delegates

[53] Addisse M, 2003, Maternal and Child Health Care, in Lecture Notes – Ethopia Public Health Training Initiative, The Carter Center, Georgia.

[54] World Health Organization, 2022, WHO Called to Return to the Declaration of Alma-Ata: International Conference on Primary Health Care, viewed August 19, 2022, https://www.who.int/teams/social-determinants-of-health/declaration-of-alma-ata

[55] Department of Health, 2012, Revised Implementing Guidelines for the Philippine Formulary System (PNFS), viewed August 19, 2022, https://www.studocu.com/en-us/document/kendrick-high-school/biology-10th/ao-revised-implementing-guidelines-for-the-pnfs/24521512

[56] Médecins Sans Frontières, 1993, Clinical Guidelines and Treatment Manual, viewed August 19, 2022, https://medicalguidelines.msf.org/en/viewport/CG/english/clinical-guidelines-16686604.html

[57] What is Curative Care?, n.d., viewed August 29, 2022, https://www.medicareresources.org/glossary/curative-care/

[58] Department of Health, 2012, Expanded Program on Immunization, viewed August 19, 2022, https://doh.gov.ph/expanded-program-on-immunization

[59] Brar S, 2018, Health Education as a Tool for Effective Primary Health Care Services. International Journal of Yogic, Human Movement and Sports Sciences, 3(1): 87–89.

[60] Santiago B, Bulatao M, Mandapat-Sanchez J, 2019, Integrating Traditional and Complementary Medicine in Universal Health Care. National Health Sector Brief, August 19, 2022, https://doh.gov.ph/sites/default/files/publications/08%20Integrating%20Traditional%20and%20Complementary%20Medicine%20in%20Universal%20Health%20Care.pdf

[61] Mallari E, Lasco G, Sayman DJ, et al., 2020, Connecting Communities to Primary Care: A Qualitative Study on the Roles, Motivations and Lived Experiences of Community Health Workers in the Philippines. BMC Health Serv Res, 20: 860.

[62] Community Health Service-Department of Health, 1996, Policy on Primary Health Care for Community Health Development.

[63] Bautista V, 1998, Philippine Experience in Health Service Decentralization. Prepared for Health Futures, in Local Government in the Philippines: Concepts and Practices in Decentralization, University of the Philippines, Quezon City.

[64] Bautista V, Legaspi P, Santiago E, et al., 2001, Assessment of Improvement Initiatives of Public Health and Medical Systems in LGUs, University of the Philippines, Quezon City.

[65] Brillantes A Jr, 1998, Decentralized Democratic Governance Under the Local Government Code: A Governmental Perspective. Philippine Journal of Public Administration, 42(1–2): 38–57.

[66] Bleich SN, Ozaltinb E, Murray C, 2009, How Does Satisfaction with the Health-Care System Relate to Patient Experience? Bull World Health Organ., 87(4): 271–278.

[67] Kroneman M, Maarse H, van der Zee J, 2006, Direct Access in Primary Care and Patient Satisfaction: A European Study. Health Policy 76(1): 72–79.

[68] Kaja P, Ruth K, Margus L, 2004, Evaluation of Primary Health Care Reform in Estonia from Patients' Perspective: Acceptability and Satisfaction. Croat Med J, 45(5): 582–587.

[69] Ortiz J, Meemon N, Zhou Y, et al., 2012, Trends in Rural Health Clinics and Needs During U.S. Health Care Reform. Primary Health Care Research & Development, 14(4): 360–366. https://www.doi.org/10.1017/S1463423612000503

[70] Rushender R, Balaji R, Parasuraman G, 2016, A Study on Effective Utilization of Health Care Services Provided by Primary Health Centre and Sub-Centres in Rural Tamilnadu, India. International Journal of Community Medicine and

Public Health, 3(5): 1054–1060. https://doi.org/10.18203/2394-6040.ijcmph2016135

[71] Mashego T, Peltzer K, 2005, Community Perception of Quality of (Primary) Health Care Services in a Rural Area of Limpopo Province, South Africa: A Qualitative Study. Curationis, 23(2): 13–21. https://www.doi.org/10.4102/curationis.v28i2.941

[72] Hodge A, Firth S, Bermejo R, et al., 2016, Utilisation of Health Services and the Poor: Deconstructing Wealth-Based Differences in Facility-Based Delivery in the Philippines, 16: 523. https://doi.org/10.1186/s12889-016-3148-0

[73] Jackson S, 2011, Research Methods and Statistics: A Critical Thinking Approach (4th Edition), Cengage Learning, Boston, 17.

[74] Posinasetti N, 2014, What do we Mean by Descriptive Research? [Online forum post], viewed September 23, 2022, https://www.researchgate.net/post/What_do_we_mean_by_Descriptive_Research

[75] Schriver B, Meagley K, Norris S, et al., 2014, Young People's Perceptions of Youth-Oriented Health Services in Urban Soweto, South Africa: A Qualitative Investigation. BMC Health Serv Res, 14: 625. https://doi.org/10.1186/s12913-014-0625-y

[76] Smith W, 2000, Does Gender Influence Online Survey Participation?: A Record-linkage Analysis of University Faculty Online Survey Response Behavior, ERIC, viewed August 23, 2022, https://files.eric.ed.gov/fulltext/ED501717.pdf

[77] Curtin R, Presser S, Singer E, 2000, The Effects of Response Rate Changes on the Index of Consumer Sentiment. Public Opin Q., 64(4): 413–428. https://doi.org/10.1086/318638

[78] Atif W, MacDonald C, 2021, Food Service Inspection Capacity: Needs Assessment in a Philippine Local Government Unit. Multidisciplinary Scientific Journal, 4(3): 531–543. https://doi.org/10.3390/j4030039

[79] Tulio J, 2015, How Safe is Your Drinking Water?, Rappler, viewed August 23, 2022, https://www.rappler.com/brandrap/health-beauty-and-wellness/102472-safe-drinking-water/

[80] Provincial Health Office, 2015, Social Sector – Health Status, viewed August 21, 2022, https://www.batangas.gov.ph/portal/social-sector/

[81] Datinguinoo M, Fumey-Nassah N, Gonzales M, et al., 2018, Dengue Elimination and Control Program of One City in the Philippines. Asia Pacific Journal of Education, Arts and Sciences, 5(4): 60–71.

[82] Billah S, Saha K, Khan A, et al., 2017, Quality of Nutrition Services in Primary Health Care Facilities: Implications for Integrating Nutrition into the Health System in Bangladesh. PloS ONE, 12(5): e0178121. https://doi.org/10.1371/journal.pone.0178121

[83] Yamashita T, Suplido SA, Llave C, et al., 2005, Understanding Postpartum Healthcare Services and Exploring the Challenges and Motivations of Maternal Health Service Providers in the Philippines: A Qualitative Study. Trop Med Health, 43(2): 123–130. https://doi.org/10.2149/tmh.2014-40

[84] Emelumadu O, Onyeonoro U, Ukegbu A, et al., 2014, Perception of Quality of Maternal Healthcare Services Among Women Utilizing Antenatal Services in Selected Primary Health Facilities in Anambra State, Southeast Nigeria. Nigerian Medical Journal, 55(2): 148–155. https://doi.org/10.4103/0300-1652.129653

[85] Teano A, 2012, Evaluation of the Maternal Health Services of the Rural Health Units in Region III, Academia, viewed August 21, 2022, https://www.academia.edu/23361545/EVALUATION_OF_THE_MATERNAL_HEALTH_SERVICES_OF_THE_Rural_Health_Units_IN_REGION_III

[86] Alizadeh D, Sheykhangafshe F, Pirabbasi G, et al., 2021, The Effectiveness of Premarital Counseling on Couples' Intimacy and Marital Satisfaction: A Systematic Review Study. Proceedings of The First International Conference on Consulting.

[87] Lee RB, 2005, Circumcision Practice in the Philippines: Community Based Study. Sexually Transmitted Infections, 81: 91. http://dx.doi.org/10.1136/sti.2004.009993

[88] Ulep V, Uy J, 2021, An Assessment of the Expanded Program on Immunization (EPI) in the Philippines: Challenges and Ways Forward, Philippine Institute for Development Studies, viewed August 19, 2022, https://pidswebs.pids.gov.ph/CDN/PUBLICATIONS/pidsdps2104.pdf

[89] Mangrio N, Alam M, Shaikh B, 2008, Is Expanded Programme on Immunization Doing Enough? Viewpoint of Health Workers and Managers in Sindh, Pakistan. J Pak Med Assoc, 58(2): 64–67.

[90] Kironde S, Kahirimbanyi M, 2002, Community Participation in Primary Healthcare (PHC) Programmes: Lessons from Tuberculosis Treatment Delivery in South Africa. African Health Sciences, 2(1): 16–23.

[91] Tamrin K, 2022, The Effectiveness of Tuberculosis Control Program in Rural Area, Indonesia. Journal of Aafiyah Health Research (JAHR) 2022, 3(1): 1–12. https://doi.org/10.52103/jahr.v3i1.943

[92] Kim A, Capeding M, Kilgore P, 2014, Factors Influencing Healthcare Utilization Among Children with Pneumonia in Muntinlupa City, The Philippines. Southeast Asian J Trop Med Public Health, 45(3): 727–735.

[93] Feasey H, Burke R, Nliwasa M, et al., 2021, Do Community-Based Active Case- Finding Interventions Have Indirect Impacts on Wider TB Case Detection and Determinants of Subsequent TB Testing Behaviour? A Systematic Review. PLOS Global Public Health. https://doi.org/10.1371/journal.pgph.0000088

[94] Sio-Aguilar J, 2019, Oral Rehydration Therapy for Diarrhea-Related Dehydration in the Philippines. https://www.researchreview.co.nz/getmedia/cb6f91ec-838c-4848-a73d-f0ce33e11a0d/Educational-Series-Oral-Rehydration-Therapy-(The-Philippines).pdf.aspx?ext=.pdf

[95] Digre P, Simpson E, Cali S, et al., 2016, Caregiver Perceptions and Utilization of Oral Rehydration Solution and Other Treatments for Diarrhea Among Young Children in Burkina Faso. J Global Health, 6(2): 020407. https://doi.org/10.7189/jogh.06.020407

[96] Boateng D, Wekesah F, Browne JL, et al, 2017, Knowledge and Awareness of and Perception Towards Cardiovascular Disease Risk in Sub-Saharan Africa: A Systematic Review. PloS One, 12(12): e0189264.

[97] Gamboa V, 1984, Oral Health Status and Traditions in the Philippines. National Library of Medicine. Int Dent J., 34(4): 257–260.

[98] Evans C, 2022, Dental Mission Trips and Humanitarian Aid Trips Benefit Everyone, Community Dental Partners, viewed August 23, 2022, https://communitydentalpartners.com/articles/dental-mission-trips-humanitarian-aid-benefits/

[99] Barroga T, Basitan I, Lobete T, et al., 2018, Community Awareness on Rabies Prevention and Control in Bicol, Philippines: Pre- and Post-Project Implementation. Tropical Medicine Infectious Disease. Trop Med Infect Dis, 3(1): 16. https://doi.org/10.3390/tropicalmed3010016

[100] Morisky D, Lyu S, Urada L, 2009, The Role of Non-Formal Education in Combating the HIV Epidemic in the Philippines and Taiwan. Prospects (Paris), 39(4): 335–357. https://doi.org/10.1007/s11125-010-9133-y

[101] Amadora N, 2000, Knowledge of HIV/AIDS Among Young Adults in Region VII. Philippine Quarterly of Culture & Society, 28(3): 363–398.

[102] Bahkali S, Bawazir A, Househ M, et al., 2017, The Role of Primary Health Care in Prevention, Early Detection, and Control of Cancer, in Transforming Public Health in Developing Nations, IGI Global, Pennsylvania, 52–67.

[103] Sabdani A, 2022, Level of Awareness and Acceptance of Government Health Services for Leprosy in Sulu, Philippines. Journal of Management Information & Decision Sciences, 25(S2): 1–7.

[104] Pati S, Chauhan AS, Mahapatra S, et al., 2017, Practicing Health Promotion in Primary Care – A Reflective Enquiry. J Prev Med Hyg, 58(4): E288–E293. https://doi.org/10.15167/2421-4248/jpmh2017.58.4.749

[105] Soriano N, 2019, Factors Affecting Blood Donation Among Experienced and Prospective Blood Donors in Manila, Philippines. Int Public Health J, 11(2): 109–116.

[106] Ogaji DS, Ko E, Agbayi N, et al., 2016, Clients' Perception of the Quality of Primary Health Service and its

Predictors in Rivers State. Journal of Community Health & Primary Health Care, 28(1): 76–85.

Publisher's note

Bio-Byword Scientific Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Scientific and Social Research, 2023, Volume 5, Issue 10
https://ojs.bbwpublisher.com/index.php/SSR

Intelligent Transportation Planning and Construction in the Era of Big Data

Can Chen*

Chongqing Energy College, Chongqing 402260, China

***Corresponding author:** Can Chen, nychencan@163.com

Copyright: © 2023 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

Abstract: Intelligent transportation planning has become increasingly important in the era of big data. By utilizing big data technology, traffic flow can be measured and managed more effectively. This leads to transportation planning that is more scientific and provides people with more convenient travel options. In this paper, the role of big data technology in intelligent transportation planning is analyzed. Subsequently. a path towards intelligent transportation planning is proposed, laying the foundation for intelligent transportation development.

Keywords: Big data era; Intelligent transportation; Planning; Role; Construction path

Online publication: October 20, 2023

1. Introduction

To ensure the smoothness of urban traffic and reduce traffic pressure, it is necessary to make full use of big data technology to conduct intelligent analysis and simulation of urban traffic conditions and plan intelligent transportation. The software and hardware facilities of big data technology should be leveraged to enhance the modernization and advancement of intelligent transportation, ensuring technical support for the sustainable growth of the urban transportation environment. It can ensure intelligent and accurate traffic operation. Therefore, it is necessary to make full use of big data methods to improve the efficiency of transportation planning.

2. Application of intelligent transportation in the context of the big data era

2.1. Traffic flow monitoring

Big data technology enables the collection of traffic-related information, including real-time traffic line speed, traffic volume, congestion status, and more, using surveillance cameras, sensors, and other monitoring equipment. Real-time monitoring of these information is helpful to understand the needs of the transportation field. Better traffic monitoring results can be achieved by transmitting and processing these data to the server. By combining historical data with real-time data analysis, it becomes possible to predict traffic flow patterns,

analyze traffic operation modes, and forecast future traffic operation data [1]. These forecast data will help the transportation department make better road planning to avoid large-scale traffic congestion. Big data technology plays a vital role in traffic planning, providing a reference for traffic signal adjustment and alleviating traffic congestion problems. At the same time, scientific planning and adjustment of roads can help balance the load of urban highways and play an important guiding role in regional transportation planning [2].

2.2. Improving travel experience

Applying big data technology in urban transportation planning improve travel experience. Big data technology allows for the integration of information, including people's travel times and preferences, enabling a better understanding of travelers' needs and population mobility. This information can then be used to formulate transportation plans that enhance the quality of transportation services. By recording various location information on mobile devices, the common travel methods of the people can be better understood. Analyzing people's travel modes and frequencies can offer valuable insights for optimizing public transportation routes and increasing the capacity of public transportation services. Furthermore, big data technology's analysis of people's travel times can provide insights into the travel time patterns of the general population, allowing for a more accurate assessment of urban traffic congestion during morning and evening rush hours. This information is valuable for developing effective traffic management strategies and alleviating traffic congestion.

2.3. Realizing intelligent management

The application of big data technology in intelligent transportation is conducive to improving intelligent traffic management capabilities and ensuring the smoothness and safety of traffic operations. Big data technology gathers location data from vehicles and pedestrians, providing the transportation department with insights into real-time traffic conditions. Analyzing this data allows for the identification of traffic congestion and enables adjustments to route planning and traffic signal optimization, ensuring smoother traffic flow. At the same time, big data analysis is also conducive to collecting traffic violations and traffic accidents, understanding which road sections in traffic operations are high-risk sections and prone to safety hazards, and taking effective improvement measures [3]. For example, traffic signal signs can be installed in areas with high accident rates as a warning for motorists and pedestrians. Illegal behaviors in traffic operations, such as running red lights, speeding, etc., can also be monitored to reduce the probability of unlawful driving.

3. Intelligent transportation planning and construction strategies in the era of big data

The utilization of big data technology can help optimize the transportation management model, establish an intelligent transportation operation network, provide guidance for various transportation planning, alleviate traffic congestion, and reduce traffic accidents. When combined with other technologies, it enables the creation of a traffic operation model for real-time traffic operations monitoring and contributes to the healthy development of transportation [4].

3.1. Strengthening network architecture

The Internet of Things (IoT) is the foundation for constructing urban intelligent transportation networks. It can accurately locate transportation operation facilities, monitor various facilities, fully use artificial intelligence (AI) and big data means, and strengthen the optimization of general technologies and underlying infrastructure platforms. The application of IoT technology can be in the form of communication networks, big data, VR

technology, and cloud computing. Information collection and transmission are achieved through remote monitoring, intelligent management, and communication coordination. Through analyzing infrastructure, traffic operation conditions, and transportation services, specific traffic application scenarios are formed, which are beneficial to autonomous driving and closed-area monitoring. Besides, the accuracy of transportation positioning can be improved through big data technology and ensure data processing efficiency [5].

3.2. Mining travel data

In the era of big data, traditional transportation distribution methods face challenges in meeting the needs of large-scale transportation development. Big data technology allows for the collection of various information, including vehicle location, dwell time, and recurrence frequency, through signal collection. With this data, it becomes possible to infer traffic operation conditions, evaluate project travel impacts, and analyze traffic operation characteristics. An origin-destination (OD) matrix can be formulated to gain insights into people's travel patterns. This can involve the analysis of daily traffic volume distribution and the study of the movement of people and vehicles across different regions. Data sources for this analysis may include sources like public transportation card swipes and mobile phone signals. For example, suppose it is found during the survey that the proportion of people travelling by car in a particular area is significantly higher than that of public transportation. In that case, it can be determined that there is a congestion problem in this area. Subsequently, the cause of the congestion can be analyzed, and corresponding solutions can be formulated and taken promptly. Analyzing data such as bus card swipes and bus positioning allows us to comprehend passenger flow at various stations during public transportation operations. It also helps in identifying the operational characteristics of public transportation, exploring the development potential of public transit, and optimizing the public transportation operation network [6]. Through dynamic mining and tracking investigation of transportation data, we can understand the operating status and passenger flow of transportation, laying the foundation for accurate transportation planning. For instance, when planning a specific road section within the city, an analysis of road traffic prediction results reveals issues such as overlapping traffic peaks in that area, which can potentially lead to traffic congestion. As a result, it is necessary to clear the congested road sections, expand the connecting channels between the central area and the crowded locations, and increase the proportion of non-motorized lanes.

3.3. Mobile navigation guide

Intelligent transportation planning under big data technology provides travelers with more effective travel guidance. Travelers can use big data and AI to plan their trips more efficiently [7]. For example, mobile navigation provides practical guidance for transportation planning and can give travelers precise advice and services.

Mobile navigation can enable a dynamic voice broadcasting mode, connecting travelers with traffic updates and providing travel route reminders along with road condition alerts. For example, a popular mobile application called Amap provides pedestrians with accurate traffic information and ways. It can form a variety of route planning navigation, which is conducive to providing more precise guidance for travelers and vehicle operations. This can lead to the optimization of bus trips, providing more precise vehicle operation information, enhancing vehicle planning efficiency, and promoting the implementation of intelligent transportation solutions.

3.4. Intelligent parking system

As the number of vehicles per household increases, parking problems have become more apparent. To address this problem, an intelligent three-dimensional parking system can be created to ensure the market-

oriented development of parking equipment. Intelligent parking is the main development direction of traffic parking systems, which aims to solve parking difficulties [8]. One approach involves establishing an intelligent parking system platform and creating a parking space database through big data analysis. This database would encompass parking resources across various areas, such as shopping malls, hospitals, hotels, businesses, and communities. The platform would also employ sensors to identify parked vehicles and gather data on parking location, duration, and vehicle details. An automated parking system would then provide drivers with real-time information on parking space availability, fee rates, and reserved parking options, allowing them to conveniently locate, assess, and reserve parking spaces based on their preferences and requirements. This service approach not only simplifies parking for drivers but also assists them in selecting the most efficient parking route, opting for a more suitable parking spot, and steering clear of unnecessary detours or traffic congestion due to parking issues [9]. In addition, a three-dimensional parking lot can be built to ensure the rationality of the parking lot location. Integrating data from intelligent transportation infrastructure, we can gain insights into vehicle congregation points and spatial distribution. This information enables the construction of three-dimensional parking facilities in congested traffic and densely populated areas. A three-dimensional garage can be formed by constructing a parking lot, using intelligent storage methods and electrical systems to build parking devices and equipment that can move horizontally and vertically.

3.5. Creating a data link system

Through the construction of a digital collection system, the intelligent transmission system can be strengthened, an intelligent and digital transportation system can be formed, the goal of building a powerful transportation country can be achieved, and the value of intelligent transportation can be enhanced. In the comprehensive planning of intelligent transportation, the data link should be fully leveraged to perform precise assessments and intelligent analyses of the transportation system using AI and big data. This involves the integration and diagnosis of the data link [10]. In this way, a multi-dimensional and multi-level traffic impact model can be form to make accurate judgments to promote the intelligent operation of urban traffic. At the same time, an intelligent transportation analysis report can be made to conduct an in-depth analysis of urban traffic congestion and its causes. By integrating collection and transmission systems, precise control of traffic operations and effective avoidance of congestion problems can be achieved, embodying the value of intelligent transportation operations. The integrated advancement of intelligent digital systems maximizes the utilization of data links, establishing an information collaborative development mechanism that enhances the effective fusion of road and pedestrian elements, resulting in a novel service model. In the event of traffic congestion, video technology is employed for identification, enabling swift assessments of road conditions and traffic flow. This is complemented by intelligent applications and vehicle navigation systems that bolster the identification and dissemination of traffic information. This collective approach enhances the efficiency of intelligent traffic management and ultimately contributes to improved travel conditions for pedestrians and drivers.

3.6. Adopting edge computing model

Edge computing refers to using intelligent devices and other technologies to realize information storage, calculations, etc., to form a complete network management and service model. The application of edge computing is based on the system's edge nodes and AI edge computing, developing high-efficiency processing of computing units and high-resolution video data analysis. The device can be connected to cameras and microwave radars to identify lanes, traffic lights, traffic signs, etc. It can be connected to the cloud platform to obtain corresponding traffic information. The related information can also be edited and set through the

computing unit, and the information transmission can be completed using the communicator. Compared with the traditional central computing model, edge computing can be combined with data collection terminals for data analysis. It does not need to transmit all data to the central server to form a unified processing model, which improves the operating efficiency and computing power of servers and processors to ensure the safety of system operation.

3.7. Simulated annealing algorithm

The application of big data in intelligent transportation can use simulated annealing algorithms to improve traffic lines' management efficiency and diversion. Traffic diversion is an integral part of transportation planning, which is beneficial to alleviating traffic pressure and balancing traffic load. The simulated annealing algorithm can simulate and search the spatial state of traffic, form a more scientific traffic diversion model, avoid deadlock in the design of some traffic planning lines, and obtain a more optimized traffic diversion effect. Bus line design is an integral part of public transportation services. Using the simulated annealing algorithm, bus lines can be optimized, including the layout of line routes and the operation frequency of public transportation. Through the objective function, we can understand the performance of various solutions in the line design scheme and form the optimal strategy. In addition to traffic diversion and line design, the simulated annealing algorithm is also beneficial to the optimization of various combinations in traffic planning. For instance, through the optimization of traffic signal placement, bus route configurations, and parking lot layouts, we can devise solutions to abstract issues. This process simplifies the challenges associated with bus route operations and enables the selection of optimal solutions from a range of transportation design alternatives.

3.8. Combining big data with artificial algorithms

Intelligent transportation planning and design can combine big data and artificial algorithms to ensure the scientific nature of transportation system design. Using artificial algorithms, such as genetic algorithms, traffic operation conditions are simulated to construct traffic models. Various factors and circulation processes within traffic are optimized to formulate the most rational traffic planning scheme. This enhances traffic operation efficiency and mitigates issues related to traffic congestion.

4. Conclusion

In summary, intelligent transportation is the development trend of urban transportation, improving transportation efficiency and allowing pedestrians to plan their trips more conveniently. Using big data technology in intelligent transportation provides more accurate information for transportation planning and design. The IoT, cloud computing, and artificial intelligence can be used to understand traffic status in real-time and reasonably build traffic roads, public transportation lines, and shifts based on traffic operating patterns and traffic conditions. At the same time, services can be extended based on the current transportation development situation, and a more scientific and convenient travel plan can be formed to address issues such as mass travel and parking, providing a reference for the healthy development of urban transportation.

Moreover, the intelligent traffic management system can create real-time data models, enhance dispatching decisions, and boost the efficiency of the transportation system. It can establish multi-modal traffic operation guidelines, employ big data techniques to coordinate and integrate various transportation modes, strategically plan travel routes, optimize traffic organization, and enhance the overall traffic environment.

Disclosure statement

The author declares no conflict of interest.

References

[1] Cui J, Liu W, Li Z, 2023, Analysis of Intelligent Transportation Planning and Construction in the Context of the Big Data Era. Transportation Manager World, 2023(1): 67–69.

[2] Ding H, 2022, Discussing the Planning and Construction of Intelligent Transportation in the Context of the Big Data Era. Engineering Construction and Design, 2022(15): 104–106.

[3] Zhang J, 2023, Intelligent Transportation Planning and Construction in the Context of the Big Data Era. Auto Expo, 2023(3): 106–108.

[4] Chen C, 2022, Construction and Research on Intelligent Transportation Planning in First-Tier Cities Under the Background of Big Data. China Flights, 2022(31): 3–6.

[5] Zhang Y, 2020, Research on Urban and Rural Planning and Intelligent Cities in the Big Data Era. Beauty and Times · City, 2020(5): 46–47.

[6] Zhang N, 2022, Research on People-Centered Intelligent Transportation Planning. China High-Tech, 2022(9): 72–74.

[7] Yang W, Li Y, 2019, Research on Applying Big Data Technology in Urban Intelligent Transportation Planning. China Strategic Emerging Industries, 2019(48): 19.

[8] Chen C, 2021, Analysis of Urban Intelligent Transportation Planning and Construction Under the New Infrastructure Environment. Modern Property, 2021(13):124.

[9] Cong X, 2022, Research on the Application of Intelligent City Concepts in Urban Transportation Planning. Famous Standardization, 2022(22): 61–63.

[10] Xie C, Li S, 2022, Discussion on the Functional Model and Planning of the Intelligent Fare Collection and Ticketing System for Urban Express Rail Transportation in the Guangdong-Hong Kong-Macao Greater Bay Area. Modern Urban Rail Transit, 2022(7): 23–28.

Publisher's note

Bio-Byword Scientific Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Scientific and Social Research, 2023, Volume 5, Issue 10
https://ojs.bbwpublisher.com/index.php/SSR

Strategies of Integrating of Physical Education and Academics

Qi He*

Chongqing Vocational College of Applied Technology, Chongqing 401520, China

***Corresponding author:** Qi He, bingyeyaoyao@sina.com

Copyright: © 2023 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

Abstract: The new goal and approach to physical education teaching in vocational colleges is to promote the development of students' moral, intellectual, physical, artistic, and practical skills. To achieve this, physical education should be integrated with academics. Therefore, we analyzed the existing problems and their causes in our college's physical education teaching and developed basic reform ideas that incorporated physical education into academic education, interspersed physical education with academic education, and co-constructed the physical and academic education based on actual teaching experiences. Besides, each school should be given adequate physical education resources, and the management methods and regulations for physical education courses should be optimized. The integrated physical education curriculum system and content should also be improved and various extracurricular activities should be carried out. In addition, a new course evaluation index should be established, which will be used to determine new teaching goals and methods.

Keywords: Vocational education; Physical education; Integration of physical education and academics; Teaching reform; Reform strategy

Online publication: October 20, 2023

1. Introduction

The integration of physical education and academics is not only about integrating physical education and academics alone, but also integrating ideological and political education, intellectual development education, and aesthetic literacy, so as to meet the requirements of educational development and student growth in the new era. However, vocational colleges usually focus on talent training based on their academic attributes, while neglecting physical education. Therefore, vocational colleges must actively explore reform ideas and feasible physical education methods so that students have the physical fitness to cope with future career and life pressures.

2. Problems faced in integrating physical education with academics in vocational colleges and their causes

2.1. Teaching issues

There mainly three aspects involved in the integration of physical education with academics: teaching

management, curriculum setting, and extracurricular activities. In terms of management, even though there is a constant influx of new teachers, the composition of the teaching team remains somewhat inadequate. There is a shortage of physical education teachers with specialized skills, and there are insufficient sports facilities and equipment that align with the integrated development of physical education. Moreover, there is a noticeable absence of specific management measures in this regard. There are specific issues in curriculum design, such as an imbalance between theoretical and practical physical education classes, the absence of courses addressing regional seasonal variations, limited adjustments to the curriculum system based on student preferences and interests for an optimized classroom experience, a lack of diverse assessment criteria, and challenges in translating assessment results effectively. Concerning extracurricular sports activities, the problems include the relatively simplistic nature of conditioning methods, a focus on intra-school sports events and clubs mainly for sports majors, and limited opportunities for extracurricular exercise and learning for non-sports majors. Additionally, there is a quantitative and qualitative mismatch between the available venues and facilities for extracurricular activities.

2.2. Cause of the problem

The causes of many of the above practical problems mainly come from three aspects: schools, teachers, and students. For example, the school pays more attention to its vocational education brand, puts more teaching workforce, material resources, financial resources, and energy into students' professional shaping and skill improvement, and ranks physical education courses at the end of public introductory courses. The school's awareness of teaching management will directly affect teachers. Physical education instructors require additional classroom hours and lack both internal and external incentives to innovate teaching methods. They struggle to receive positive feedback regarding students' learning outcomes. Moreover, students in vocational colleges, especially those not majoring in physical education, often perceive physical education as optional. They view these classes as mere relaxation or recreational sessions. However, with a proper learning attitude, students can cultivate healthy exercise habits and reap the benefits of physical education classes.

3. Basic ideas for the reform of physical education teaching in vocational colleges under the integration of physical education and academics

3.1. Integrating physical education into academics

Under the concept of integrating physical and academic education, vocational colleges should ensure that the education system provides necessary moral support and scientific research services to optimize the content and methods of physical education, improve students' performance in sports, and cultivate talents for various sports projects. For example, ideological and political teachers are should introduce stories and influential characters in sports so that students can learn the importance of physical education and change their stereotyped understanding of physical education. Schools should consider arranging additional interdisciplinary online and offline teaching and research events. These initiatives can facilitate the sharing of effective teaching methods and experiences among physical education instructors. They can also help refine classroom organization and activity design strategies for these instructors.

3.2. Physical education should be interspersed with academics

Integrating physical education with academics is crucial. The physical education system should aim to offer enhanced services that complement the academics system within schools. This shift is aligned with national policies and aims to revamp the training and education approach for sports talents. For example, knowledge and

techniques, sports, emotions, and culture during physical education lessons. Teaching resources can be drawn from traditional Chinese martial arts culture and intangible cultural heritage connected to sports. This approach allows students to gain a diverse understanding of sports, including disciplines like football and tennis, from a unique standpoint. It helps them achieve learning objectives related to knowledge and skills, encompassing the "four basics and four abilities." Additionally, vocational colleges should enhance the talent cultivating system, so as to produce outstanding physical education teachers, professional coaches, and referees. This talent development cycle contributes to an overall improvement in teaching standards for the subject.

3.3. Co-construction of physical education and academics

The idea of co-construction of physical education and academics emphasizes the need to use sports events as a carrier to determine the common goal of integrating physical education and academics, forming a joint force in education, and improving the existing physical education model. For example, vocational colleges can collaboration with middle and high schools to create a one-stop talent training model. Before students enter vocational colleges, they can be informed of some of the sports available at school through admission notices and orientation. Training and school-specific sports activities can stimulate students' interest and enthusiasm for sports. Alternatively, different colleges and universities can collaborate in organizing winter and summer water sports to create new models and activities for joint education, talent cultivation, and sports teaching in the same city, bringing a more novel sports learning experience to students and allowing some students to develop in sports as well as creating more opportunities for professional student athletes to improve their skills and broaden their horizons [1].

4. Feasible strategies for physical education reform in vocational colleges

4.1. Allocating teaching resources based on the "one school, one product"

The "one school, one product" concept means that each school has their own unique characteristics. This concept underscores the importance of each vocational college developing its distinctive physical education teaching style. Such an approach aims to narrow the gap in students' biological education knowledge and skill development within the framework of integrated physical education. Hence, each college should allocate teaching resources with the support of various teaching promotions and preferential policies issued by the country, provinces, and municipalities. This will help revitalize traditional physical education teaching and sports projects in the new era.

Schools can choose track and field, basketball, swimming, badminton, table tennis, tennis, martial arts, or Sanda as their specialty sports; the selection should be based on the sports venues, and equipment and facilities available in the school, the quality of specialized physical education teachers, and the students' interests. After the project is determined, resources must first be allocated to coordinate with traditional physical education classes: the duration of a lesson should be controlled to about 90 minutes, and at least two sessions should be arranged per week to focus on allowing students to learn the school's brand projects and improve their special skills. Certainly, in the context of enhancing the integration of physical education, schools can employ morning exercises, recess activities, and physical sessions between classes to effectively promote a high-quality physical education curriculum within their institutions. Furthermore, resources from both within and outside the school can be coordinated to diversify teaching approaches. This may involve organizing specialized extracurricular activities on campus, establishing partnerships with professional sports clubs like football and tennis, or collaborating on inter-school competitions with other sports-focused institutions. On this foundation, efforts should be made to transform the school's flagship sports projects into exemplary physical education activities.

This can be achieved by securing funding, mobilizing educational resources, and utilizing these initiatives to enhance the school's sports culture, boost students' physical well-being, and foster healthy, self-motivated exercise habits among students [2].

4.2. Optimizing course management methods and rules and regulations

Alongside promoting the reform of physical education in vocational colleges through specialized projects, there is a need to optimize the management approaches for traditional physical education courses. This gradual shift should aim to achieve systematic and large-scale improvements in teaching methodologies.

The first step is to reconstruct the internal management of the college. For example, a physical-academic integration office and a special team can be set up, headed by a physical education director and critical teachers, to manage of sports venues, physical education activities, and physical tests. There must be at least a two-tiered structure within the group, with professional physical education teachers, counselors, and party-building staff sharing responsibilities. Second, the construction and training system for physical education teacher teams should be improved. To achieve this, it is essential to ensure a more balanced composition of the teaching team concerning teacher age, teaching experience, academic qualifications, professional titles, and sports proficiency. Special attention should be paid to assessing teachers' practical educational competencies, as well as their expertise and track record in fostering students' sports skills.

Moreover, the teacher evaluation mechanism should be adjusted to mobilize their enthusiasm for teaching and research. Thirdly, it is imperative to revamp the management protocols for sports facilities and equipment, both within and outside the school premises, with a primary focus on optimizing their utilization. This can be achieved by pooling resources from various stakeholders to establish and maintain facilities such as track and field fields, football pitches, swimming pools, and tennis courts. Additionally, outdated equipment should be replaced with new ones. A dedicated physical-academic integration office should oversee the unified management of these facilities. This means making them accessible to on-campus students, the wider community, and sports clubs during non-scheduled physical education class times, holidays, and off-days [3].

4.3. Improving the integration of physical education and academics in terms of the curriculum

Building upon the established national or local unified curriculum, it is advisable to introduce supplementary elements of physical education that cater to the individualized and diverse needs of students. These additions should aim to infuse excitement and inclusivity into the curriculum, taking into account the distinctions between boys and girls while maintaining a holistic teaching approach.

The extensive curriculum system should include traditional physical education courses, like track and field, football, basketball, and physical education courses centered around one school and one product [4]. Under this system, the content of classes also needs to be adjusted. For example, a variety of sports activities can be introduced in courses that focus on training the students' physical coordination, muscle strength, and endurance. These activities can include winter sports, swimming, local martial arts, or traditional folk sports. Adaptive transformation of conventional courses can also be carried out. For example, if the school requires facilities and resources for curling, it can embark on land curling initiatives. These projects can harness student enthusiasm for activities while nurturing their sports skills. Moreover, efforts should be made to introduce new courses that can be carried out in different weather conditions and locations, ensuring minimal disruption to teaching activities. The curriculum can be expanded to include activities like skateboarding, rock climbing, and competitive cycling to cater to students' diverse sporting interests and enhance the overall curriculum [5].

4.4. Creating a variety of extracurricular sports activities

Effective physical education teaching not only helps students acquire in-class knowledge and attain subject goals, but also provides them with ample opportunities for extracurricular physical activity. This approach encourages the development of lifelong exercise habits through regular engagement in sports activities. To this end, vocational colleges should organize a variety of extracurricular sports events aimed at cultivating a vibrant campus sports culture, thereby encouraging student participation [6].

Campus sports clubs should be established and effectively managed, ensuring the inclusion of students with varying sports backgrounds and abilities, and promoting a sports-friendly atmosphere where friends, classmates, and partners are encouraged to participate [7]. The school should provide necessary support and help, such as ensuring that each club has its unique theme and direction, systematic sports activity planning, and using campus websites, public accounts, and offline activities to promote club activities. Besides, the star club of this college or school can also be mentioned every semester. Secondly, schools should play a central role and organize competitions to promote sports and health knowledge, improve students' sports skills, and instill the "health first" concept in the students' minds. The level of competition can vary, whether it is within a college, between societies or schools, or even between school sports teams and amateur or professional clubs. The competition events should also be diverse, regularly supplemented, and updated, including additions like fixed-point shooting, shooting, fancy shuttlecock kicking, rope skipping, and slow-speed cycling. The proportion of group and team competitions can be increased, and individual participation in projects can be made less challenging to enable greater student involvement. Additionally, motivation can be provided by acknowledging competition awards and outstanding group achievements [8].

4.5. Constructing a new course evaluation index

Teaching reform should involve the development of an evaluation system tailored to the integration of physical education and academics in vocational colleges. The evaluation results should then be used to iteratively adjust the teaching schedule and course selection or identify promising sports talents [9].

This evaluation index should cover several significant aspects: goal integration, ideology integration, resource integration, and measure integration. First, it should establish primary, secondary, and tertiary indicators for each aspect. For example, under the ideology integration aspect, it should include two main sections: "Sports as a Vital Component of Education" and "Education as a Crucial Function of Sports." Sub-indicators should evaluate the implementation of the "health-first" educational concept, the establishment of a concept of diverse, open, and integrated education, and the execution of the goal to comprehensively improve students' physical fitness. Under the measure integration aspect, it should assess educational measures targeting all students, approaches to physical education faculty development, and regulations governing facility and equipment planning. The assessment should involve input from the leaders and participants in the physical education-academics integration office, physical education teachers, specialized sports coaches, students, and teachers from other disciplines. The process and final evaluation feedback should be consolidated to create a record of the effectiveness of the teaching reform at this stage. Through collaborative research activities, problems identified in the results should be collectively analyzed, directing solutions to determine the focus and path of physical education teaching reform for the next stage. These should then be systematically implemented in terms of adjusting teaching content and optimizing teaching methods [10].

5. Conclusion

To effectively advance the implementation of the physical-academic education integration policy, it is crucial to

meticulously address the finer points of the policy, focusing on practical aspects of its execution. Adaptations to teaching methods should be made based on the current status of physical education and the specific challenges faced in vocational colleges. The reform efforts must encompass both the overarching framework and individual components, aiming to strike a harmonious balance between tradition and distinct characteristics. Systematic allocation of human and material resources should support these endeavors, fostering an environment conducive to teaching innovation and overall development.

Disclosure statement

The author declares no conflict of interest.

References

[1] Zhang G, Xie W, 2023, Research on the Reform Path of Physical Education Teaching in Colleges and Universities Based on the Perspective of Sports and Education Integration. Journal of Hubei Open Vocational College, 36(2): 167–169.

[2] Shen H, 2022, Research on the Reform of Physical Education Teaching in Higher Vocational Colleges Under Integrating Physical Education and Education. Journal of Liaoning Higher Vocational Schools, 24(7): 36–39.

[3] Liu J, Chen M, 2021, From the Integration of Physical Education to the Integration of Physical Education – Taking Physical Education as an Example. Journal of Hubei Open Vocational College, 34(2): 138–139.

[4] Gao C, Zhou H, 2020, Development and Construction of Physical Education Courses in Colleges and Universities Under "Integration of Physical Education and Academic Education." Sports Illustrated, 2022(20): 208–209.

[5] Dong N, 2022, Reform and Practical Exploration of Physical Education Teaching in Higher Vocational Colleges Under Integrating Physical and Academic Education. Computer Enthusiasts (Popular Edition), 2022(10): 232–234.

[6] Dou Z, 2023, A Brief Analysis of Physical Education Classroom Teaching Implementation Strategies Oriented Towards Integrating Five Educations. Primary School Teaching Research, 2023(16): 87–89.

[7] Shang Y, 2023, Research on the Reform Path of Physical Education Teaching in Colleges and Universities from the Perspective of Physical and Academic Education Integration. Education and Teaching Forum, 2023(9): 84–87.

[8] Zhao Y, 2023, The Connotation, Difficulties, and Strategies of Interdisciplinary Theme Integration in Physical Education Teaching. Physical Education Teaching, 43(5): 13–14.

[9] Wu T, 2022, Thoughts on the Reform of Physical Education Teaching in Higher Vocational Colleges Under the Background of Integrating Physical and Academic Education. Industry and Science and Technology Forum, 21(20): 166–167.

[10] Li S, Zhou L, 2022, Research on the Deep Integration of Information Technology and Physical Education Teaching Process - Based on TPACK Teaching Deduction. Bulletin of Sports Science and Technology Literature, 30(8): 185–188.

Publisher's note

Bio-Byword Scientific Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Scientific and Social Research, 2023, Volume 5, Issue 10
https://ojs.bbwpublisher.com/index.php/SSR

Artificial Intelligence and IET: Subversion, Supervision, and Reconstruction

Di'ao Xie*

Shashi Middle School, Jingzhou 434000, Hubei Province, China

***Corresponding author:** Di'ao Xie, 13997603677@163.com

Copyright: © 2023 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

Abstract: By interpreting the complex phenomena contained in the term "Artificial Intelligence" (AI) from the perspective of International Economic Law (IEL), this article aims to demonstrate that Information and Communication Technology (IET) is influencing the developments in AI, and these impacts can be either positive or negative. Throughout this process, IET is also undergoing significant and practical transformations itself. Overall, the three most important themes of this article are the interaction between AI and IET, of which the disruptive impact of AI, the need for AI supervision, and the direction of IET reconstruction. By exploring the three clues: By investigating three key areas: advancements in AI-related technology, economic consequences, and discussions surrounding legal reforms, we can uncover the disruptive influence it has on IET. Amidst this significant influence, numerous debates have emerged concerning specific topics such as regulatory subjects, entities, and approaches, particularly in various governance scenarios. This article will assess the transformations within IET and contemplate the necessity of future adaptations. As artificial intelligence rapidly advances, IET plays a pivotal role in shaping AI across multiple domains, encompassing its development, deployment, and utilization.

Keywords: AI; IET; Reconstruction

Online publication: October 20, 2023

1. Introduction

Firstly, the nature and definition of artificial intelligence (AI) should be clarified. However, the term "AI has not yet been clearly defined in its scope. It is also divided into different types and developmental patterns; even though within clearly defined fields, the methods and technologies used are greatly different. Traditional legal definitions of AI are trapped between ambiguity and extension, diversity, and specificity. AI can be defined as a specific field of research or an algorithm that has a certain function, or it can be a general term for robots. However, a comprehensive analysis is needed to study the components of AI and its applications. AI technology constitutes a complex socio-technical system, which involves humans, machines, algorithms, data and etc. Moreover, its deployment in a wide range of fields has triggered various legal issues such as laws related to data protection and privacy, anti-discrimination, and intellectual property, and tort law.

In terms of continuity and disruption, the fundamental ideas of modern AI can be traced back to the 1950s, while exponential growth in data volume and computing power has enabled AI technology of machine learning through "deep" neural networks to make significant progress since the turn of the century. Machine learning's reliance on large-scale data has become a typical example of the deep integration between AI and economic digital transformation. These changes can help achieve long-term goals of Information and Communication Technology (IET), but they may also break and potentially subvert some of the IET's basic principles, especially the commonsense IET reached since the 1947 *General Agreement on Tariffs and Trade* (GATT) was signed and the 1995 World Trade Organization (WTO) was established.

In terms of supervision, the lack of regulation has become a prominent feature of AI. The deployment of various digital technologies can shape and adjust human behaviors and can help expand, distribute, and redistribute social wealth and resources. While at the same time about empowering, it may also exacerbate inequality and other social issues. Concerns about the negative impacts of AI are growing and quite a few initiatives have been taken. These initiatives often blur the distinction about values whose ethical design principles are usually human-centered. Among all of the legislative and regulatory actions taken by governments, the European Union's (EU's) law-making is the most advanced. However, due to the characteristics of "academic-industrial complex" of AI, more supervision from transnational standard-setting agencies is needed. IET provides a meta-regulatory framework, aiming to supervise the different regulatory initiatives formulated by different countries. However, the IET has a history of advocating regulating measures by national institutions and preferring multilateralism, which will create new issues.

These profound changes have sparked significant interest in the reconstruction of IET. In several traditional domains, particularly the multilateral trade dispute settlement mechanism and the "bilateral investor-state" dispute settlement mechanism, there is an imminent need for reform and adjustment. The huge geopolitical changes in the world caused by the rise of China have called into question about the importance of the WTO and its ability to maintain the operation of the multilateral trading system. The great geological and political changes brought by the rising of China are making people to doubt the importance of WTO and the ability to maintain the operation of multilateral trading system. The development and application of AI are transforming of the global economy, which necessitates the reconstruction of IET.

2. The rise of AI and the transformation of the global economy

The subversiveness of AI will be presented from three dimensions: In terms of the technical aspects, contemporary AI technically emerged from ideas from the 1950s. It was not until the 21st century that the rapid advancement of computing power and exponential growth in data scale began to bear fruits. Secondly, in terms of economy, the integration of AI with other digital technologies has gradually and significantly changed the global economy. Thirdly, in terms of legalslatives, these changes have subverted many concepts and principles that IET has long relied on.

2.1. Technological development of AI

As was mentioned in the previous chapter, the term "AI" is hard to be strictly defined legally. The term spans research areas across disciplines such as computer and data science, philosophy and ethics, psychology, cognitive science, and neuroscience, which are primarily oriented towards the study of human and machine thinking. Even within computer science, the definition of AI varies [1]. At the Dartmouth Society in 1956, John McCarthy and his team defined "machines that can use knowledge to solve problems like humans" [2]. Till this day, this definition still sums up the main research areas of AI [3]. It also uses human intelligence as a benchmark

to evaluate the development of AI. The Turing test is a famous example of applying this benchmark [4]. There is also a paradox in this definition: once a machine masters a task that was originally only done by humans, the task loses the definition of "intelligence" [5]; At the same time, what is simple for humans is not easy for machines [6]. However, the status of human intelligence as the benchmark is also gradually being replaced [7].

Human beings are not only a benchmark for evaluating AI's progress, but also the decision makers in the development and application of AI. AI development is a complex process, in which humans, machines, algorithms, and data are all key components (see **Figure 1**). The research field of AI widely spans perception, reasoning, knowledge planning, and communication. The proposed paradigms for this include modeling based on logic and knowledge (where human rationality and professional knowledge are converted into code), statistical methods (which incorporate traditional probabilistic methods and "data science"), as well as decentralized and evolvable AI sub-symbol systems [8].

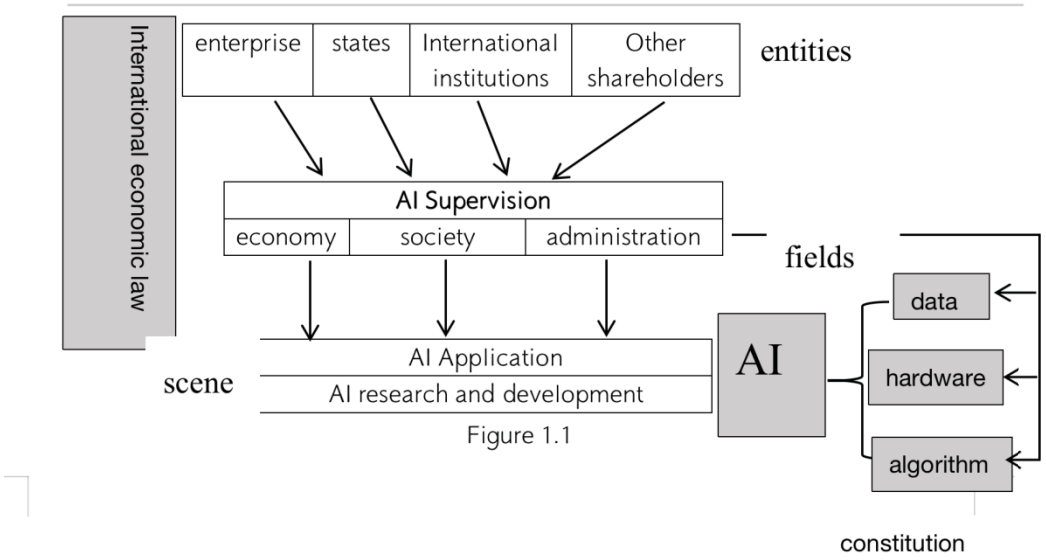


Figure 1. The composition of artificial intelligence

Deep learning is the most essential machine learning technology based on neural networks and also the most important AI technology [9]. At the beginning of this century, network data content increased exponentially and computing power significantly improved at the same time, and deep learning finally took off. The sudden emergence of its various application prospects has certain implications for both AI supervision and IET. Despite the incredible progress made over the past two decades, AI technology still has its limitations. Contemporary AI is still largely limited to specific tasks that utilize large amounts of data to train algorithms. Non-specific tasks or tasks without reliable data are beyond the capabilities of contemporary AI technology. However, it is undeniable that the impact of AI technology on the global economy is already tangible and may further increase in the next decade.

2.2. AI and the transformation of the global economy

The rise of AI is intertwined with other technological developments, most notably is the digitalization, computing, and interconnection, the latter of which is highly benefited from the development of the Internet. AI relies on these basic technologies of the digital age and coexists with other advanced technological achievements.

The term big data is used in almost the same way as AI, which refers to the generation and analysis of

data. However, the quantities of which overpass the human comprehension. Only through the computing power of machines can the value of the data can be "mined" [10]. Because of its large volume, big data itself cannot be analyzed without the help of machines. However, it does not constitute "intelligence" at any degree. Only when data analysis is performed by machine learning methods and when the algorithms can detect a certain conclusion or prediction pattern can it be called AI. Both technologies rely on large amounts of data, making data an extremely important but controversial resource in the AI field.

Both big data analysis and AI rely on the flow of data, while the flow of the data through the interconnected networks makes up the Internet. The underlying infrastructure, such as cloud computing, makes data storage and processing available remotely (Infrastructure as a Service or IaaS). The development of AI increasingly relies on a symbiotic relationship with cloud computing. As part of the business, Platform as a Service (PaaS), cloud computing also provides virtual AI development with the environment that integrate access to large data and algorithm warehouse [11].

The Internet of Things (IoT) refers to the internet connectivity embedded in objects or "things." It has also demonstrated its relevance to AI. As a typical example, Internet refrigerators have gradually become popular in the market. However, the IoT actually goes far beyond the home dimension in essence and plays an important role in the interconnection and synchronization of machines in agriculture, industry, and other fields. As long as IoT devices have sufficient computing power, it may be possible to retrain AI algorithms with local data in a decentralized manner, thereby reducing the reliance on centralized cloud computing.

All of the digital technologies mentioned above are inherently tied to the physical world, as they are interconnected with it. For example, data is stored in data centers with undersea cables that facilitate transnational internet connectivity. AI services can be provided online and across borders, and AI also enables industrial robots to complete tasks locally. Industrial robots are playing an increasingly significant role in manufacturing as they introduce new models of automation and mechanization. The increased feasibility of domestic production and overseas service delivery has brought about negative fluctuations in the intensity of trade in goods and services, it also caused complex consequences for the future of workers [12]. Although the application of AI in different fields will evolve in different ways, the general characteristic of AI will still be to create insights based on big data deep learning. The ability of AI to generate information based on existing data has become a fundamental capability for a large number of enterprises. Ciuriak describes this shift as a transformation from a knowledge-based economy to a data-driven economy [13]. AI is the core of the data-driven economy which can create more data, information, and knowledge from existing data. AI's high dependence on data also implies that, in real-world interactions with various advanced digital technologies, re-evaluating dogmatic principles, such as data transformation, becomes essential.

2.3. Subversion of AI and IET principles

The development of AI and the economic transformation centered on it bring unique challenges to IET and the international trade law. With the establishment of the WTO, the *General Agreement on Trade in Services* (GATS) and the *Agreement on Trade-Related Aspects of Intellectual Property Rights* (TRIPS) expanded the scope of international trade law beyond commodity trade. At the same time, the creation of GATS led to a split in the international trade system between trade in goods and trade in services. In the complex system of positive lists (indicating market access) and negative lists (indicating continual restrictions) within GATS, countries maintain control over the liberalization of more services. However, distinguishing between goods and services has become increasingly challenging in light of economic realities.

Beyond the distinction between goods and services and the expansion of AI-related services, the

transformation of the global economy brought about by AI has subverted the principles on which the IET relies on. Another example involves in the incentive structure constructed by international intellectual property law, which pursues dual goals of the TRIPS Initiative: promoting technological innovation and the transfer and diffusion of technology. As AI itself comes to be defined as an "inventor," questions arise about whether basic assumptions about human agency remain valid.

The conceptual basis of IET is still unclear. International Economic Law (IEL) is often understood to be fundamentally related to "trade" (the cross-border exchange of goods and services), and "investment" (the long-term investment of resources by enterprises in the host country). In the global development and deployment of AI, the utilization of inherently multi-jurisdictional infrastructure may render the concept that this economic activity constitutes "trade" analytically unsustainable and politically unfounded. Similarly, the cross-border operation methods of digital enterprises will also be changed, which can no longer be operated locally at all. The local production methods and resource investment that are similar to traditional "investment" will also be greatly varified. It is still a major challenge for IET to conceptualize, categorize, and quantify different transnational business interactions in the AI economy.

3. AI supervision and IET's backwardness

AI technology has introduced new challenges to the existing regulatory framework, necessitating the urgent establishment of a new regulatory structure. Policymakers must ensure that legitimate public policy goals, such as fair competition, non-discrimination, privacy, and security, are achieved in this environment while avoiding the restraint of innovation that may result from excessive regulation [14]. Governments around the world are considering various forms of AI regulation, ranging from "AI ethics" and requirements on transparency about public and private algorithmic decision-making to debates over certain AI use scenarios (such as government use of facial recognition technology). At the same time, multi governments are also competing to formulate national AI strategies. In order to understand the complex and dynamic relationship between AI and IEL, this article expounds on AI regulation under three perspectives, as shown in **Figure 1**.

The first perspective distinguishes respective fields of AI regulation (economic, social, and administrative ones respectively) and raises the question about on which purpose and framework under which AI regulation is carried out. The answers to these questions on whether to regulate AI, how to regulate AI, and who should regulate AI are closely related to balancing the effects of innovation and interpreting existing social displays.

The second perspective breaks AI into several components: hardware, algorithms, data; and raises the question of how each part will be regulated by domestic and international laws and industry standards under the framework provided by the IET. Although hardware and algorithms are the important parts and are becoming an increasingly distributed subject on trade, in this article, our focus is on "data regulation as AI regulation."

The third perspective identifies different actors which involves AI regulation, including companies, countries, international organizations, and other stakeholders, so as to assess whether the IET's regulatory interventions on them are effective.

It is clear from the analysis that the regulatory target has never been an abstract "AI." It is about creating a regulatory framework that is consistent with the complex and distributed nature of AI research, development, and deployment, and is also commensurate with the economic, social, and administrative impacts. This requires different regulatory interventions made by different stakeholders in different areas for different aspects of AI at different stages.

3.1. Cross-field AI supervision

As is shown in **Figure 1**, regulation in the three fields of economy, society, and administration all promote a certain framework for AI regulation around concepts such as innovation, harmony, and liability, and they intersect with the IET in different ways.

The first type of AI regulation seeks to pursue economically oriented goals. Labeled as "economic regulation" by the Organization for Economic Co-operation and Development (OECD), this type of regulation generally aims to improve market efficiency for goods and services and includes, but is not limited to, assessment of technical standards, competition law, intellectual property rights, etc. The data-driven economy has led to a winner-take-all dynamic situation, where certain companies also gain monopoly status and infrastructure importance [15]. In digital markets, anti-competitive behavior carried out by a few dominant players has become a major regulatory target in an increasing number of jurisdictions. Furthermore, the WTO, as a system firmly committed to open and fair trade, upholds the principle of non-discrimination, and numerous WTO agreements are structured to ensure "fair trade." The government's shift toward economic regulation raises the question of whether such AI regulation could create new disputes under WTO law. In other words, can traditional trade rules prompt the governments to create new AI innovation?

The second group of AI regulations is influenced by non-economic goals, which often aims to protect society as a whole or certain groups within the society. Although this kind of "social" regulation is not completely different from "economic" regulation, it pays more attention to privacy, security, discrimination, and other regulatory measures. In this case, the winner-take-all nature platform of the economy highlights the need to strike a balance between trade efficiency and other policy objectives. One of the challenges faced by WTO's e-commerce negotiations is accusations that its proposed digital trade rules will benefit large companies at the expense of small businesses. Civil society groups have been pushing for development-focused digital industrialization, signaling the need to ensure universal benefits of the digital economy and narrow the digital divide. Exceptions to general trade disciplines provided by the WTO allow members to use domestic measures to promote non-trade values. However, there are still questions about whether existing exceptions to trade rules are over- or under-inclusiveness of AI applications when it comes to public moral issues regarding data ethics and self-driving systems.

The third AI regulation is "administrative regulation," which defines how the public and private sectors actually work, and thus can be used as a means of setting the conditions for technological progress. This includes ensuring accountability, transparency, human technology control and other AI regulatory measures. How does the IET drive mechanisms ensure that responsibilities for AI application impacts are properly distributed? Can the IET incorporate transparency requirements that require AI systems to be designed and implemented in a form that allows for oversight? Perhaps the most fundamental but controversial example of this is the increased transparency of algorithms, applications, and underlying data to ensure public oversight [16].

3.2. Data supervision is AI supervision

Given the scope of data-driven technologies, legal and policy analysis needs to fully take the technological developments into consideration. Besides, AI-specific regulation only makes sense when regulatory objectives are closely related to AI technology. In other words, the specific regulatory approach to AI should be able to cover new legal issues and take full account of the "AI system life cycle" and its "supporting ecosystem" [17].

Indeed, some regulatory initiatives eschew the name "AI" entirely, instead distinguishing between the regulation of "algorithmic systems" (either fully human-coded or partially self-trained) and the regulation of "data" [18]. In order to prevent forced disclosure of source code, algorithms are increasingly subject to new types

of protection by the IET [19]. At the same time, contrary to the mainstream discourse of the IET, the development of many algorithms is carried out by academia and industry using "open source" licenses, which are freely available. But the same cannot be said for open source when it comes to data and hardware. Despite various "open data" and "open hardware" initiatives, specialized AI hardware, particularly microprocessors optimized for machine learning, is becoming more expensive.

AI-specific regulation creates additional requirements for data quality, transparency, and accountability that would complement existing data protection laws, such as the EU's *General Data Protection Regulation* (GDPR). Data law regulates a decisive factor in contemporary AI technology because it relies on machine learning algorithms and is fundamentally data-driven. Therefore, this article takes a broader perspective – viewing data governance as AI governance – to explore the interplay between AI and data governance. AI, robotics, 3D printing, blockchains and the IoT are converging into a "digitally connected network of production, communication, and consumption." Therefore, the tension between emerging regulatory intervention in AI and existing international trade and investment rules can be understood based on the perspective on data control and data mobility.

3.3. Privatization of AI supervision

Many AI principles were created through a collaborative, multi-stakeholder effort involving a wide range of experts. In order to seek normative consensus around AI technology governance, relevant stakeholders are included. Initiatives such as codes of conduct, voluntary standards, and best practices were set to guide AI actors through the AI lifecycle, including monitoring, assessing, and addressing the harmful effects of using AI. These initiatives are fundamentally driven by the academically industrialized complex's desire which has a transformative impact on the technological development as well as the deployment of AI in the society, and they are largely regulated by a variety of often transnational standard-setting bodies. Governments are only slowly beginning to respond to the changes brought about by AI through legislative and regulatory actions. The IET provides a (meta)regulatory framework in the hope of governing these regulatory initiatives, but its preference for state-led regulation and multilateralism also creates certain obstacles in this regard.

Broad acceptance of multi-stakeholder AI governance raises key questions about normative development. Some non-governmental organizations have withdrawn from multi-stakeholder initiatives on AI governance due to concerns about corporate monopoly and lack of change. AI governance was initially dominated by "AI ethics" because it was widely believed that such a framework was best suited for managing emerging technologies. After initially embracing these initiatives, governments also moved toward more traditional forms of regulation. The EU is considering formulating a comprehensive AI regulatory model for other regulated industries such as the chemicals and pharmaceutical industries.

Therefore, the question of how big a role governments should play in AI regulation has resurfaced. Taking the consensus formed by the autonomous vehicle industry as an example, the development of disruptive innovation essentially involves changes in the governance framework and will also break the boundaries of existing trade rules. The WTO needs to respond to the significantly fragmented character of data governance – including market-driven or self-regulatory data alternatives. If governments reassert themselves as AI regulators, the WTO may become more familiar with this regulatory body, but it will also face considerable conceptual challenges.

3.4. AI and IET reconstruction

WTO may not be the best venue for global AI governance. When a specific AI-related domestic regulation

constitutes a violation of rights or obligations stipulated in an international agreement, whether special or additional dispute settlement rules and procedures should be incorporated into the international trade system to deal with digital trade disputes is the question [20]. But at the same time, one may never find an ideal, non-controversial forum. From an organizational capacity perspective, it certainly makes sense to leverage the WTO and its existing network of actors, agreements, and institutions to embrace AI technologies and applications. Outside the WTO, bilateral, regional, and multilateral efforts are seeking to adapt the IET to keep pace with the changing face of the AI economy.

Increasing negotiations among various WTO member states have led to various dynamic interactions and innovative arrangements, leading to the initial adjustments in the IET. The growing number of member states joining free trade agreements (FTAs) has also resulted in new rules to regulate government management of cross-border data flows, privacy and personal data flow, competition, and source code change [21]. For example, the *Comprehensive and Progressive Agreement for Trans-Pacific Partnership* (CPTPP) and the *United States-Mexico-Canada Agreement* (USMCA) both contain provisions that facilitate the "free flow of data." This adjustment has tended to focus on the pressing challenges of data management, but has not moved beyond addressing broader AI governance issues. Some people advocate developing new mechanisms at the WTO level to provide basic data management principles to deal with the management challenges of cross-border data flows.

Specifically, the emerging geopolitical, economic and technological disputes between China and the United States may have an everlasting impact on the IET's future adjustments in AI. The "free flow of data" increases efficiency and welfare, but also facilitates economic problems that exacerbate inequality. Attempts to regulate data flows may vary and be controversial, which requires a more broadly defined international framework. The *Comprehensive Economic and Trade Agreement* (CETA) references international standards for data protection in the context of e-commerce, which can be seen as part of its approach to manage the AI economy. Japan's G20 Data Free Flow of Trust (DFFT) initiative, endorsed by the World Economic Forum, is another attempt to reconcile competing interests under a common framework [22].

The *Digital Economy Partnership Agreement* (DEPA) among Chile, New Zealand and Singapore presents an innovative reconfiguration and adjustment of the AI economy at the IET level [23]. DEPA recognizes that the lines between trade and non-trade are blurring, and therefore takes a broader perspective on AI and the digital economy, covering a wider range of issues [24]. DEPA not only strengthens the obligations of existing "digital trade" provisions, such as no tariffs on electronic transmissions, non-discriminatory treatment, promotion and facilitation of e-commerce, data flow rules, paperless trade, electronic certification, and data localization, but also includes new rules on algorithms, digital inclusion, financial technology (FinTech) as well as ethical and governance frameworks related to AI [24]. DEPA's "modular" approach to regional cooperation — dividing the agreement into "modules" covering various rights and obligations within digital economic areas—marks its "comprehensive" free trade agreement with the WTO. There has been a deviation from the single commitment approach.

In addition to DEPA, some WTO member states have reached new agreements on a broader topic of the digital economy to expand and deepen cooperation under the existing free trade agreements, and non-multilateral agreements has begun to expand. For example, the *Australia-Singapore Digital Economy Agreement* (ASDEA) was signed in August 2020, replacing the e-commerce chapter of the *Singapore-Australia Free Trade Agreement* (SAFTA) signed before 2003. Like DEPA, ASDEA "moves away from the increasingly outdated and unhelpful narrow notion of 'electronic commerce' in international trade negotiations," which provides a broader coverage of technical and regulatory cooperation on emerging issues [24]. Although there are

significant differences in specificity, cross-border data flows, personal data protection, intellectual property and algorithms, FinTech and RegTech, digital standards, and access to government data are all addressed to some extent.

Before Trump was elected as President of the United States and withdrew from the *Trans-Pacific Partnership Agreement*, the parties to DEPA and ASDEA — Australia, Chile, New Zealand, and Singapore — that are the members of the CPTPP, had already included the "e-commerce" chapter in their agreement. There was a very significant influence from the United States. However, even under Trump's presidency and even after withdrawing from the TPP, the United States continued to add essentially the same building blocks to further agreements, including the *United States-Japan Digital Trade Agreement* (USJDTA) reached in October 2019 [25]. Similar to ASDEA, the USJDTA includes rules regarding digital products, cross-border data flows (prohibiting data localization measures), cybersecurity, protection of proprietary computer source code and algorithms, cryptography, and access to government data. DEPA, ASDEA and USJDTA demonstrate the ambition of certain WTO members to take a leadership role in global rule-making for the AI economy. Their shared endorsement of the "free flow" of data creates tension with the EU's GDPR, which restricts the cross-border transferring of personal data [26]. Future multilateral rules need to take these systemic differences into account, for example by distinguishing between different types of data flows.

Creating and amending treaties is not the only way to change the IET. The ongoing reinterpretation of the IET may gradually clarify the boundaries of existing regulations, but may also conversely reveal areas where new rules are needed. The pressure for change has brought about practical urgency and conflicts with the IET's commitment to stability, predictability, and legal certainty, further raising questions about trade-reliant economic growth.

In the context of customs procedures under the principle of trade facilitation, the IET's practice of utilizing digital technologies focuses mainly on automation and electronic communications (paperless trade). Combined with the new situation of "text is data" and the increasingly data-driven development prospects of IET, if the regulatory power of computer code is more widely used as a supplement or replacement for traditional IET rule-making [27], digital technology may lead to a more radical reconstruction [28]. Recognizing that man-made law is not the only way to formulate and enforce trade rules or resolve disputes, which has opened up a research agenda on the convergence of debates on IET's integration of legal technology and the commonalities between "human law" and "computer law" [29]. When economic interactions are in dense or complexity beyond human understanding, the use of AI technology may be particularly necessary to support the creation and implementation of IETs [30].

On this basis, one would ask fundamental questions about the need to further restructure IET: How should IET adapt and reposition itself as a relevant framework in this era of AI? What key elements should be incorporated into the new vision for the IET? Lastly, how do we deal with the reconstructed IET and shape the future direction of the global AI economy?

Disclosure statement

The author declares no conflict of interest.

References

[1] Stone P, 2016, Artificial Intelligence and Life in 2030: One Hundred Year Study on Artificial Intelligence - Report of the 2015 Study Panel, Stanford University, viewed October 7, https://ai100.stanford.edu/sites/g/files/sbiybj18871/

files/media/file/ai100report10032016fnl_singles.pdf
[2] McCarthy J, 1955, A Proposal for the Dartmouth Summer Research Project on Artificial Intelligence, Stanford University.
[3] Mitchell M, 2019, Artificial Intelligence: A Guide for Thinking Humans, Picador, London
[4] Saygin AP, 2000, Turing Test: 50 Years Later, Minds and Machines, 10: 463.
[5] Hofstadter D, 1979, Gödel, Escher, Bach: An Eternal Golden Braid, Basic Books, New York.
[6] Minsky M, 1986, The Society of Mind, Simon and Schuster, New York.
[7] Dick S, 2019, Artificial Intelligence, Harvard Data Science Review, 1(1.1): 1–8.
[8] Corea F, 2019, An Introduction to Data: Everything You Need to Know About AI, Big Data and Data Science, Springer, Cham.
[9] Goodfellow I, 2016, The Deep Learning Revolution, Deep Learning MIT Press, Cambridge.
[10] Baldwin R, 2019, The Globotics Upheaval: Globalisation, Oxford University Press, Oxford
[11] Ciuriak D, 2020, Economic Rents and the Counters of Conflict in the Data-Driven Economy, CIGI, viewed October 7, 2023, https://www.cigionline.org/publications/economic-rents-and-contours-conflict-data-driven-economy/
[12] EU-UK Trade and Cooperation Agreement (TCA), n.d., European Commission, viewed October 7, 2023, https://commission.europa.eu/strategy-and-policy/relations-non-eu-countries/relations-united-kingdom/eu-uk-trade-and-cooperation-agreement_en
[13] The United States Department of Justice, 2020, Justice Department Sues Monopolist Google for Violating Antitrust Laws, DOJ Press, viewed October 7, https://perma.cc/7RQV-QS72
[14] Kaminski M, 2020, Understanding Transparency in Algorithmic Accountability, Cambridge University Press, Cambridge.
[15] Moses LB, 2013, How to Think about Law, Regulation and Technology: Problems with Technology as a Regulatory Target, Law. Innovation and Technology, 5(1): 1–20.
[16] Wendehorst C, Woopen C, Haberer J, 2019, Opinion of the Data Ethics Commission, Data Ethics Commission of the Federal Government, Berlin.
[17] Irion K, 2021, AI Regulation in the European Union and Trade Law: How Can Accountability of AI and a High Level of Consumer Protection Prevail over a Trade Discipline on Source Code, SSRN, viewed October 7, 2023, https://ssrn.com/abstract=3786567
[18] MK Land, JD Aaronson, 2020, Human Rights and Technology: New Challenges for Justice and Accountability. Annual Review of Law and Social Science, 16: 223–240.
[19] Johnson K, Access Now Resigns from Partnership on AI Due to Lack of Change Among Tech Companies, Venturebeat, viewed October 7, 2023, https://venturebeat.com/2020/10/14/access-now-resigns-from-partnership-on-ai-due-to-lack-of-change-among-tech-companies
[20] Cowls J, Floridi L, Prolegomena to a White Paper on an Ethical Framework for a Good AI Society, SSRN, viewed January 11, 2023, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3198732
[21] Pasquale F, 2020, New Laws of Robotics: Defending Human Expertise in the Age of AI, Harvard University Press, Cambridge.
[22] Burri M, Polanco R, 2020, Digital Trade Provisions in Preferential Trade Agreements: Introducing a New Dataset. Journal of International Economic Law, 23: 187.
[23] World Economic Forum, 2020, Data Free Flow with Trust: Paths towards Free and Trusted Data Flows, World Economic Forum, viewed October 7, 2023, https://perma.cc/KYR7-AZAM
[24] Digital Economy Partnership Agreement, 2020, viewed October 7, 2023, https://perma.cc/U23E-URUS
[25] Drake-Brockman J, 2020, Australia-Singapore Digital Trade Agreement: Setting New Benchmarks in Trade

Governance, The University of Adelaide, viewed October 7, 2023, https://perma.cc/3FLA-WEPE

[26] Office of the United States Trade Representative, n.d., U.S.-Japan Digital Trade Agreement Text, viewed October 7, 2023, https://perma.cc/UUA9-7NUD

[27] Yakovleva S, Irion K, 2020, Pitching trade against privacy: Reconciling EU governance of personal data flows with external trade, International Data Privacy Law, 10:201.

[28] Alschner W, 2017, The Data-Driven Future of International Economic Law. Journal of International Economic Law, 20(2): 217–231.

[29] Mohen J, Roberts A, 2020, Cracking the Code: Rulemaking for Humans and Machines, OECD Publishing, Paris.

[30] Hildebrandt M, n.d., Project COHUBICOL, Computational Law, viewed October 7, 2023, www.cohubicol.com

Publisher's note

Bio-Byword Scientific Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Scientific and Social Research, 2023, Volume 5, Issue 10
https://ojs.bbwpublisher.com/index.php/SSR

Analysis of Berth Allocation Problems of Mainline and Feeder Vessels due to Ship Delays

Baowei He*

Dalian Maritime University, Dalian 116026, Liaoning Province, China

***Corresponding author:** Baowei He, hbwqd@126.com

Copyright: © 2023 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

Abstract: With the development of the shipping industry, port terminals are becoming increasingly busy. As an essential resource at the front of the terminal, berths are responsible for connecting the seaside and landside of the port. The efficiency of loading and unloading operations depends very much on the berth allocation. However, due to certain events such as weather factors and ship failures, ships are often delayed in arriving at the port, which severely impacts the berth allocation plan. To effectively deal with the effects of ship delay on the berth allocation plan, this paper studies the berth allocation problem of mainline and feeder vessels, considering the impact of uncertainty.

Keywords: Port management; Berth allocation; Mainline and feeder vessels; Ship delay

Online publication: October 20, 2023

I. Introduction

Berths are one of the core resources at the terminal front, and the issue of berth allocation has always been the research focus of many scholars. Berths can be divided into continuous and discrete berths according to their types. A continuous berth is a continuous shoreline wall with no clear division between berths, while discrete berths are independent.

Kim and Park [1] began to study issues related to berth allocation as early as 2003. Han and Zhao [2] considered the priority weight of ships with different loads, corresponding this priority to the ship's time in port, and established a constraint and mixed integer programming model. Xie *et al.* [3] studied the discrete berth allocation problem, launched an integer programming model to minimize the total cost of ship berth offset and time offset, and designed three branch pricing algorithms with different initial column generation methods. Zeng *et al.* [4] considered the loading and unloading priorities of mainline and feeder vessels, established a mixed integer programming model, and designed a heuristic algorithm.

Whether a ship can finish loading and unloading on time depends on whether it docks at the berth. Therefore, berth allocation needs to be considered from a dynamic perspective so that the berth allocation plan has a specific anti-interference ability. To reduce interference on the container terminal operating system and related costs, Zeng and Zhang [5] studied the issue of how to adjust the berth allocation plan due in the event of

interference in container terminals and quay crane scheduling plans. They measured system disruptions from various angles and built a model for managing these interferences.

The aforementioned studies have examined the berth allocation problem both in static and dynamic contexts. While certain scholars have delved into prioritization within berth allocation, they have not addressed the dynamic scenario where the priority of mainline and feeder vessels comes into play.

2. Problem description

In actual operations, the container terminal will collect berthing ship information in advance within a fixed operation plan period and then formulate an initial operation plan based on the berthing duration of the ship and the prioritization of the ships. Large ships are usually the mainline vessels. The mainline vessels are mainly responsible for transporting large quantities of import boxes and unloading them at the dock to complete the import. Feeder vessels are generally small ships, which are mainly responsible for unloading mainline vessels and diverting import boxes. Therefore, when formulating a berth allocation plan, mainline vessels have higher priority than feeder ships.

In the operation of frontier terminals, some ships might experience delays in reaching the port due to unpredictable events like adverse weather or sea blockades. Upon receiving information about such delays, the terminal must act promptly to adapt the ship's berth allocation plan accordingly. As the completion of loading for feeder vessels hinges on mainline vessels finishing unloading first, it is essential to take into account the priority order between mainline and feeder ships when making adjustments to the ship's berth allocation plan.

In summary, this article addresses the research problem as follows: A container terminal initially creates a berth allocation plan within a set planning period upon receiving ship arrival details. However, uncertainties during the project execution can lead to ship delays. Taking into account the priority of mainline and branch line ships, a berth reallocation plan is devised to minimize ship delay costs and offset the initial berth expenses within the planning period.

3. Mathematical model

3.1. Model assumptions

(i) The impact on the ship's balance during loading and unloading operations is not considered; (ii) the influence of tides and waterways on the entry and exit of the ship are not considered; (iii) the information of the ship's original operation plan is known.

3.2. Symbol description

S is the gathering of mainline vessels arriving at the port (including delayed ships); Q is the gathering of branch line ships; i, j is the shipping number. If the main line ship (j) corresponding to the feeder vessel is i, θ_{ij}, is 1; otherwise, it is 0. l_i is the length of ship i; h_i is the loading and unloading time of the ship i; L is the total length of the line. Ship i's arrival time is T_i^{arrive}; the ship i's original expected departure time is T_i^{leave0}; ship i's waiting time for berthing is T_i^{wait}; the ship i's actual unberthing time is T_i^{leave}. Ship i's original planned berthing position is P_i; the exact berth position of ship i after adjusting the initial plan is p_i. M is a large enough constant; C_i is the unit cost of deviating from the original berth; C_2 is the unit time penalty cost of the ship's demurrage. If the berthing time of the ship j is later than the ship i, xt_{ij} is 1; otherwise it is 0. If the berth position of the ship i is on the right side of the ship j, xl_{ij} is 1; otherwise, it is 0.

3.3. Model constraints

$$minF = \sum_{i \in S,Q} C_1 \Delta_i + C_2 (T_i^{leave} - T_i^{leave0}) \quad (1)$$

$$p_i + \frac{l_i + l_j}{2} \leq p_j + M(1 - xl_{ij}), \forall i \in SVQ, \forall j \in SVQ, i \neq j \quad (2)$$

$$T_i^{arrive} + T_i^{wait} + h_i \leq T_j^{arrive} + T_j^{wait} + M(1 - xt_{ij}), \forall i \in SVQ, \forall j \in SVQ, i \neq j \quad (3)$$

$$xt_{ij} + xt_{ji} + xl_{ij} + xl_{ji} \geq 1, \forall i \in SVQ, \forall j \in SVQ, i \neq j \quad (4)$$

$$\frac{l_i}{2} \leq p_i \leq L - \frac{l_i}{2}, \forall i \in SVQ \quad (5)$$

$$T_i^{leave} = T_i^{arrive} + T_i^{wait} + h_i, \forall i \in SVQ \quad (6)$$

$$\Delta_i \geq |P_i - p_i|, \forall i \in SVQ \quad (7)$$

$$\Delta_i \geq |p_i - P_i|, \forall i \in SVQ \quad (8)$$

$$[(T_i^{arrive} + T_i^{wait}) - (T_j^{arrive} + T_j^{wait})]\theta_{ij} \leq 0, \forall i \in 0, \forall j \in 0 \quad (9)$$

$$p_i \in [1, L] \quad (10)$$

$$xt_{ij}, xt_{ji}, xl_{ij}, xl_{ji}, \in \{0, 1\} \quad (11)$$

The objective function (1) represents the cost associated with minimizing the ship's deviation from its initial berthing position, as well as minimizing the delay cost. Constraints (2) to (4) specify that the distance between any two ships during berthing should not exceed the total length of the berth. Additionally, these constraints address operational conflicts between any two ships. Equation (6) represents the ship's unberthing time; Constraints (7) and (8) linearly represent the length of the ship's offset berth. Constraint (9) represents the correspondence between mainline vessels. The feeder vessels of must be able to berth after the mainline vessels berth. Constraints (10) and (11) determine the acceptable value ranges for the decision variables.

4. Case analysis

In this scenario, the article took 24 hours as a fixed planning period, and the pier length was 1200 meters. A total of ten ships arrived at the port during the planning period, including three mainline ships (Ship 1, Ship 2, and Ship 3), and the rest were feeder ships. The initial berth plan of the ship is shown in **Table 1**. A mainline vessel and a feeder vessel were randomly selected from the planning period, and a mathematical programming solver is used to solve the problem. The adjustment plan is shown in **Table 2**, with C_1 was set to 50, C_2 set to 2000, and the objective function value was 12800.

Table 1. Initial berth allocation plan

Ship number	Captain (m)	Homework duration	Arrival time	Departure time	Berthing position
1	260	13	0	13	1040
2	280	10	1.5	11.5	750
3	200	12	2	14	300
4	120	8	3.5	11.5	520
5	150	10	12	22	100

Table 1 (continued)

Ship number	Captain (m)	Homework duration	Arrival time	Departure time	Berthing position
6	200	9	14	23	1070
7	120	8	13	21	800
8	110	8	13.5	21.5	605
9	120	9	14.75	23.75	420
10	130	6	14.75	20.75	265

Table 2. Adjusted berth allocation plan

Ship number	Captain (m)	Homework duration	Arrival time	Departure time	Berthing position
1	260	13	0	13	1040
2	280	10	6.5	16.5	730
3	200	12	2	14	330
4	120	8	3.5	11.5	520
5	150	10	14	24	100
6	200	9	14	23	1090
7	120	8	13	21	930
8	110	8	13.5	21.5	535
9	120	9	14.75	23.75	420
10	130	6	14.75	20.75	265

5. Conclusion

In this paper, we investigated the berth allocation problem for both mainline and feeder ships, taking into account potential delays. Then, we developed a mixed-integer linear programming model that incorporates the priority of mainline and feeder ships, translating it into mathematical constraints. The model's efficacy was confirmed through the solution of an illustrative example, which demonstrated its ability to effectively handle ship delays.

In future research, the impact of waterway conditions on ships entering and leaving the port can be examined, and the integrated optimization of scheduling for both waterways and berths can be considered.

Disclosure statement

The author declares no conflict of interest.

References

[1] Park Y-M, Kim KH, 2003, A Scheduling Method for Berth and Quay Cranes. OR Spectrum, 25(1): 1–23.

[2] Han X, Zhao S, 2014, Constraint Programming Model for Berth Allocation Problem Under Time Window Constraints. Journal of Liaoning University of Engineering and Technology (Natural Science Edition), 2014(07): 983–987.

[3] Xie F, Wu T, Zhang C, 2019, A Branch-and-Price Algorithm for the Integrated Berth Allocation and Quay Crane Assignment Problem. Transportation Science, 53(5): 1427–1454.

[4] Zeng Q, Feng Y, Du P, 2016, Container Terminal Berth Allocation Model for Trunk and Branch Line Ship Connection. Systems Engineering Theory and Practice, 36(01): 154–163.

[5] Zeng Q, Zhang Q, 2009, Simulation Optimization Model and Algorithm for Container Berth Allocation Interference Management. China Science and Technology Papers Online, 2009(10): 742–746.

[6] Zeng Q, Hu X, Yang Z, 2010, Container Terminal Berth Allocation-Loading Bridge Scheduling Interference Management Model. Systems Engineering Theory and Practice, 2010(11): 2026–2035.

Publisher's note

Bio-Byword Scientific Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Scientific and Social Research, 2023, Volume 5, Issue 10
https://ojs.bbwpublisher.com/index.php/SSR

From a Sacred Space to an "Exhibition Platform": The Changes in the Nature of Modern Genealogy

Meijie Xie*

School of Sociology, Beijing Normal University, Beijing 100091, China

***Corresponding author:** Meijie Xie, 202031041004@mail.bnu.edu.cn

Copyright: © 2023 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribu tion and reproduction in any medium, provided the original work is cited.

Abstract: This paper studies the history and development of the three genealogies of the S clan in 1946, 1994, and 2016, revealing the nature of the genealogy's transformation from a sacred space to an "exhibition platform." In traditional rural society, when the reproduction and daily life of the people completely revolve around their clan, the genealogy is regarded as a "sacred and inviolable" item because kinship is greatly valued and genealogy clarifies a person's ancestry. Since the establishment of the People's Republic of China, due to changes in social structure and concepts, the functions of the genealogy gradually disappeared, and the sanctity of family genealogy has also weakened. Nonetheless, middle-aged and elderly individuals are leveraging their economic influence to assume a more significant role within the genealogy, transforming it into a platform for middle-aged and elderly people to showcase their achievements.

Keywords: Genealogy; Clan; Sacred space; Exhibition platform

Online publication: October 20, 2023

1. Introduction

Genealogy is an important element in a clan. Contemporary Chinese clans are gradually transitioning from a "social community" [1] to a "club style clan" [2], with significant changes in the ideology, compilation methods, and rules, which in turn changes the nature of genealogy. Research on this topic has pointed out that in terms of the author, style, content, and other aspects of the compilation, genealogy has been transformed from being led by Confucianism to being without ideological guidance [3]. Secondly, there is a clear intergenerational differentiation in the compilation of genealogies, with the elderly valuing the "cultural connotations" of the clan, while the young value the function of the "address book" more [2]. Thirdly, with the improvement of a woman's status, women are becoming increasingly important in the compilation of genealogies [4]. However, these studies have not emphasized the significance of genealogy for clans and its impact on clans and rural society. Therefore, this aspect will be explored in this paper.

Through field and textual research on the three genealogies of the S clan in 1946, 1994, and 2016, it was found that the significance of the genealogy for the people has gradually shifted from being a sacred item to an "exhibition platform." By analyzing the changes in the nature of genealogy, we attempted to extract an

important mechanism for the changes in the nature of clans.

2. Genealogy as a sacred space and its construction

Genealogy is a social organization that is linked by three things: ancestral halls, genealogies, and clan fields [5]. Genealogies are an important basis for determining the membership rights of the clan. Besides, they are an important means to gain respect for the clan and establish a foothold in local communities. Genealogy is a representation of a clan's cohesion, organizational ability, and economic strength [6]. Once established, it becomes an enduring and organized entity that is not easily destroyed, carrying permanent value [7].

2.1. The origin of sacredness: The function and significance of genealogy for clans

Society is constantly creating sacred things from ordinary things, and the sanctity of genealogy is determined by its function and significance for the clan. Firstly, genealogy determines the boundaries of the clan as a social group. A clan is a relatively closed social group connected by blood [8]. The genealogy also determines the social membership of the clan members. Besides, when there are disputes between clans, genealogies also act as important evidence. Secondly, genealogy also determines the social structure and corresponding social norms within a clan. Genealogy serves as a vital instrument for organizing relationships based on blood ties, determining appropriate forms of address, and guiding social interactions within a clan [5], laying the foundation for interpersonal relationships among its members [9]. Furthermore, genealogy serves as a crucial repository for documenting a clan's historical narrative, with its primary psychological function being the commemoration of ancestors and the encouragement of descendants' aspirations for progress [6].

Overall, the genealogy organizes and defines the social structure and norms of the clan in written form, making the boundaries of the clan clearer, the group structure more stable, and the members can better identify with the clan. In this context, the greatest ambition of a clan is often to build ancestral halls and modifying genealogies. Once the genealogy has not been revised for more than thirty years, there is a strong sense of oppression and guilt toward ancestors and descendants. It was under the urging of oppression and guilt that the people of the S clan began compiling their genealogy in 1946.

In 1946, due to the impact of war, the S clan had not compiled a genealogy for decades, which made the clan chief (Chief A) at the time very anxious. Chief A considers genealogy to be a symbol of clan cohesion and a vital instrument for nurturing "harmonious and amicable clan relationships, generational distinctions, mutual respect, and the absence of estrangement." The absence of genealogy, in his view, has resulted in a "lack of uniform discipline," diminished filial piety, the complete absence of ancestral customs, and a loosening of the ties among clan members.

During the growing season in 1946, the S clan drew 20% of its labor force to participate in compiling genealogies. The process involved appointing representatives from each clan branch to research and augment the ancestral narratives, validate details regarding clan members' personal information, family status, and occupational background, and examine the collective assets of the clan. This process took two months. In the same year, the grain production of the S clan decreased by 10%, which was detrimental for them as they could barely produce enough food and clothing for themselves. After they had successfully compiled their genealogy, the S clan held a special ceremony, and each genealogy was placed on the altar at the main entrance of the eldest son's house of each branch. Incense was burned day and night for offerings, and the sale of genealogies was strictly prohibited.

Genealogy has always been a sacred item in traditional societies, with limited practical functions in daily life [10]. It is basically worshipped as a deity and put on a shelf [8]. But it is precisely the state of sacredness that

has become a symbol of the identity of the owner of the genealogy.

2.2. The development of sacredness: The meaning of genealogy for clans

The genealogy is sacred because the clan worships it. The sacred space does not exist naturally, but is endowed with sanctity by humans through their culture, experience, and desires when defining, limiting, and depicting it [11]. Having a name on a genealogy signifies that a person belongs to a clan. The lives of the clan members revolve around the clan. In everyday life, the clan serves as the fundamental social unit in rural communities [12], playing a pivotal role in organizing and overseeing various aspects of daily life [13]. Economically, the clan functions as a "legal entity with shared assets [14]. From an ideological standpoint, individuals frequently exhibit unwavering loyalty and attachment to their clans [15].

The position of a clan member in the genealogy determines his/her position within the clan. The most important part of the genealogy is the genealogy table, which records the lineage and passing of all clan members. Genealogy represents the social significance of a clan's life. As the saying goes "If a clan member is not included in a genealogy, it is equivalent to not having lived." After death, people have to go back to their ancestors. Without registration on the genealogy, a person would not know where they are going to be buried, and nobody would mourn for them.

Under the influence of this cultural tradition, members of a clan hold great faith in doing this practice. The committee responsible for compiling genealogies allocates expenses based on population, which is close to the cost of a family's rations for half a year. However, clan members are usually very enthusiastic about repairing genealogies, and if they would contribute either financially or physically depending on their capabilities.

In summary, as the fundamental community in rural society, clans depend on each other for survival. With the backing and acknowledgment of the clan, clan members maintain a fundamental sense of "reverence" for the genealogy. Being included in the genealogy is both their duty and a source of personal honor.

3. The changes in the compilation methods and norms of contemporary genealogy

Since the founding of the People's Republic of China, traditional rural society has undergone significant changes due to the influence of modern national construction, modernization, and marketization. Clans have evolved into more of a cultural concept, [16] and the way that genealogies are compiled is also gradually changing, from being guided by Confucianism to being solely determined by the local social structure [17].

3.1. From patriarchy to gender equality

The family structures of traditional clans are formed based on the patrilineal lineage, with women at the edge of the clan. Since the establishment of the People's Republic of China, the status of women in rural societies has improved through the implementation of new marriage laws and the establishment of a new rural political and economic system. Patriarchy has quickly been replaced by new concepts and principles such as "women's liberation" and women being as important as men. While the genealogy still formally includes the concept of "encouraging women to strictly adhere to traditional female norms" within the family rules and instructions, notable changes have occurred in the documentation of women, highlighting an elevated status for women within the lineage map.

According to the rules of genealogy compilation, daughters and their husbands are excluded from the genealogy. As for the daughters-in-law, only their surnames are included without their full name or the information of their families. However, between 1994 and 2016, the names of daughters and their husbands began to appear in genealogies, and the full names and family information of daughters-in-law have also been

included.

Since 1994, all blood relatives within the S clan, including daughters, could be included in the genealogy, and daughters-in-law can have their full names and family information included in the genealogy. However, the daughter and son-in-law need to pay a certain fee (100 yuan) to be included in the genealogy. This cost is actually not much compared to the money spent by the male members of the clan, this entry fee indicates that the daughters- or sons-in-law obtained the right to access the genealogy through economic means. The daughters- and sons-in-law of the S clan were also very willing to pay. In 2016, the daughters and sons-in-law were allowed to have equal status as the sons as long as they paid the same amount of money. As long as the family pays, the entries for the daughter-in-law can be very long. The increase in female entries highlights the elevated status of women in the clan.

3.2. From seniority to highlighting personal value

Genealogies were traditionally compiled strictly according to seniority, from old to young. However, after social transformation during the collectivization period, the concept of elders being superior to youth was greatly challenged. The principle of hierarchy gradually transformed into the principle of equality.

In traditional Chinese writing, conveying concepts of social hierarchy and status is often achieved through the use of vertical orientation, relative positions within the text, and the presence or absence of blank spaces in characters. This writing technique is also employed in genealogies. Both the 1946 and 1994 editions of the S Clan genealogy used this format, emphasizing the father as the central figure and the order of generational progression through upper and lower sections of the text. However, in the 2016 genealogy, the writing style transitioned to a horizontal format, eliminating the vertical dimensions of hierarchy and status. Instead, it emphasized equality between fathers and sons across generations. Furthermore, in the lineage map, individual information became more detailed, encompassing aspects such as education, work experience, life stories, and more.

In 1994, the previous generation's genealogical data from the 1946 edition was continued. The genealogy committee collected information through inquiries with clan members. During this period, landlords still held a degree of authority. As migration became more common, many entries were filled in by the head of a clan branch. By 2016, the genealogy underwent a revision. The committee sought information from clan members on a family-by-family basis. Clan members reported their own information to the head of the clan. However, during this period, decision-making authority shifted towards the collective family, and the head of a clan branch could no longer modify the information provided.

Genealogy compilers no longer possess the authority to filter or control the information included in genealogies. Compilation now heavily relies on individuals providing their own information, which, in turn, encourages individuals to use financial incentives to emphasize their status within the genealogy. An example of this is the inclusion of personal biographies. In accordance with previous genealogy compilation norms, unmarried deceased individuals were not allowed to be registered in the genealogy. This was because the clan viewed "inheritance" as the true indication of an individual's membership in the clan. In a specific instance, there was a soldier from the S clan who sacrificed his life during wartime. He was not included in the 1994 genealogy but was incorporated into the 2016 genealogy. This is because the clan members collectively believe that sacrificing oneself for the country is an honorable act and should not disqualify someone from being considered a member of the clan simply because they have no descendants. Every clan member can have a personal biography in the genealogy for only 10,000 yuan. If one wants to add a family photo, he/she is required to pay an additional 1000 yuan. Biography is not written by a genealogical committee, but rather by an

individual, which is then sent to the genealogical committee for direct printing without making any changes.

The conventional standards of social hierarchy once constrained the representation of an ordinary person's life in genealogies. These entries were limited to basic information such as birth and death years, residence, and offspring. The primary focus of the clan was centered around the act of giving birth to future generations. However, the contemporary refinement of these genealogical entries not only underscores the depth of an individual's life experiences but also significantly broadens the collective significance of the clan's world.

3.3. From distinctive relativity to non-blood relationship

The purpose of compiling a genealogy was to define the blood relationships and kinship of a clan. Therefore, the branches of the clan were prioritized. Traditionally, when recording an individual's name in the genealogy, the customary practice involved listing the person's first name directly. The father's name was placed above, followed by the wife's name below, and then the son's name was recorded underneath. Special cases that pertained to unconventional family bloodlines, like stepsons, instances of infidelity, or adoption, were explicitly indicated. However, in the 2016 genealogy, all of these norms that used to reflect distinctions in familial relationships were disregarded.

Although the bloodlines of some families are rather chaotic, they are still accepted by the clan members. On one hand, the process of compiling genealogies has transitioned to rely more on emotion rather than strict order. On the other hand, the reduced familiarity between different clans has diminished the importance and significance of one clan towards another. Some individuals even express the sentiment that they would prefer not to be included in the genealogy if recognition is not mutual. In this evolving context, both genealogists and ordinary individuals have a decreased desire to adhere strictly to the traditional rules.

Nevertheless, the influence of individuality on traditional rules has become more pronounced, resulting in a disorderly application of rules, leading to simplistic or even ambiguous entries for ordinary individuals. Conversely, clan elites have started to utilize genealogies as a means of self-expression, causing genealogies to transform into platforms for self-display.

4. Genealogy as an "exhibition platform": A type of competition

As the rules of genealogy compilation began to shift from being patriarchal and seniority-based to being based on emotional connection and economic status, genealogy is no longer a tool for recording clan property and historical facts, or showcasing a clan's strength. During this process, the nature of the genealogy gradually changed from a sacred space to an "exhibition platform."

4.1. Who is competing: Intergenerational differences

The members who are considered elites in a genealogy are often members who were actively involved in the process of genealogy compilation. These elites invested more money and effort in the process of clan construction and resolved conflicts between families. Therefore, they want their contributions to be highlighted in the genealogy, so as to establish their authority.

There has been a division in the compilation of genealogies. Many elderly people born before and during the early stages of liberation have a deep affection for their clans, and were also the main advocates and leaders of the revision of the genealogy in 1994. The thirty-year process of collective construction has led to the disappearance of many old practices in genealogy compilation. In the absence of old precedents, compilers at that time created a new paradigm for genealogy continuation through literature search, recollection, and other means. At that time, the elderly held much authority in genealogy writing.

During the period of collectivization, many middle-aged people began to open up the boundaries of their clans and work together with other clans. Following the land division into households, social conflicts escalated, prompting the resurgence of mutual assistance relationships founded on blood ties. Middle-aged individuals gradually recognized the significance of "clans" in their everyday lives. In the process of compiling the genealogy, the hierarchy of a clan is clearly mapped and the members of the clan are clearly listed, along with their lineage and blood relationships with one another.

In 1994, the genealogy compilation committee was composed of 19 members, including a chairman aged 70–80, a deputy chairman aged 70–80, a chief editor aged 80 or above, a deputy chief editor aged 70–80, a finance officer aged 40–50, and a liaison officer aged 30–40. The three co-majors were 60–70 years old, 50–60 years old, and 40–50 years old, respectively. The ten editors comprised three members aged 60–70, four members aged 50–60, and three members aged 40–50. Due to the fact that young people had already started working outstation at that time, many of them did not participate in the compilation process, and they relied on their elders to collect the information needed.

The importance attributed to clans and genealogies by family members had started to vary across generations. With active involvement from the elderly, a neutral stance from middle-aged individuals, and reluctant cooperation from the youth, the genealogy was successfully compiled. The cost, which was shared by the extended family, roughly equals one month's living expenses. The older generation bore the responsibility for funding and cost control. Compiling genealogies was primarily driven by its significance for the elderly.

The compilation of genealogies in 2016 became a "carnival" for middle-aged and elderly people. Clan leader F expressed pessimistically that after his generation passes, this practice could only be maintained for one more generation. When young people born in the 1980s and 1990s grow up, they no longer have the sense of mission and reverence for their ancestors. Perhaps, they may even hold an indifferent attitude towards the genealogy. In 2016, the compilation of genealogies was mostly led by elderly people, and even middle-aged people did not participate in it. The compilation committee consisted of one chairman, one vice chairman, one editor-in-chief, three vice editors-in-chief, one finance personnel, one liaison officer, three associate editors, and ten compilers, with a total of twenty-one members. The executive director of X County Genealogy Research Association was also specially hired as an advisor. Among the 21 people, 3 were aged 80 and above, 12 were aged 70–80, and 5 were aged 60–70. There were no participants under the age of 50. The finance and liaison personnel were relatively young. The participants were mostly retired elderly people. Due to the improvement of the financial capabilities of each household, the funds for the funds allocated for genealogy compilation we a decent amount.

As generations evolve, the sanctity of the genealogy within the clan gradually decreases. The sacredness of genealogies is most profoundly embodied in the elderly, who possess a profound understanding of the significance of genealogies for the entire clan. They are also the ones most dissatisfied with the phenomenon of "having closeness and estrangement without elders and children, and having elders and children without closeness and estrangement" resulting from uncompiled genealogies. In 1994 and 2016, they played a pivotal role in genealogy compilation and subsequently became the driving force behind genealogies as a performance platform. Middle-aged individuals have grown up in rural society and thus harbor a certain sense of identification and belonging to the blood community. However, their grasp of more profound concepts such as intimacy and dignity remains relatively weak. Under the subtle influence of the elderly, they have come to comprehend the importance of genealogy, though the sacred meaning of genealogy has gradually diminished due to a lack of urgency and anxiety. The younger generation who grew up after the reform and opening up lack the experience of working together and have not truly participated in the resolution of clan conflicts, so their

sense of belonging to the clan is constantly weakening. Young people who grew up outside of rural society are generally ignorant of the sanctity and importance of genealogies. Therefore, most young people believe that the compilation of genealogies is a "game for the elders."

4.2. Competition through financial status

Since the 1990s, with the rise of migrant workers, rural society has gradually moved towards mobility and openness. The communication of people in rural areas is no longer ethics and community-based. Instead, they have grown to be more individualistic. The principle of compiling genealogies has also shifted from strictly following old norms to relying on economic status. The genealogy has become a platform for ethnic people to transform their economic status into their political and cultural status within the tribe. The middle-aged and elderly are the main "actors" and "audience" of the genealogy exhibition platform, and most of them obtain more entries through economic means.

Due to significant changes in the financing methods for compiling genealogies, the rules for compiling genealogies have shifted from being based on clan norms to being based on economics. In 2016, in order to raise funds, the allocation method changed from being per person to being based on the number of words. At that time, the average apportionment amount was 100 yuan per person. However, due to the changes in the fundraising method, the traditional rules were bent to fit the demands of the members. The number of words or entries in the genealogy soon became a symbol of financial status.

In 2016, another section was added to the newly revised genealogy, titled "Record of the Charisms of the Sages in the Clan." To be included in this section, individuals were required to pay 10,000 yuan. According to statistics, a total of 18 people, constituting 25% of the clan (including their joint families), chose to participate. The total cost of compiling the entire genealogy reached approximately 300,000 yuan. This transformation shifted the purpose of imparting a neutral genealogy as a moral model for people to admire and learn into a performance platform where individuals could showcase their strengths through economic means.

During the compilation of genealogies, following the principle of economy, middle-aged and elderly elites have made donations and shared their family photos in the "Record of the Charisms of the Sages in the Clan." They hope to gain recognition from their peers and ancestors through these contributions. In the midst of competition and celebration among these middle-aged and elderly elites, the younger generation often finds themselves as bystanders. The abundant material resources in contemporary life render the human and material resources required for genealogy compilation negligible for united families. Within the context of intergenerational relationships marked by "filial piety but disobedience": descendants often aim to fulfill their parents' wishes and make them **"**happy**"** in this competitive environment.

4.3. Why competition happens: Remaining relevant

When the principle of compiling genealogies shifted from being based on clan norms to being based on economics, the nature of genealogies underwent significant changes. The importance of a genealogy lies not only in its role of illustrating the lineage and emphasizing kinship, but also in its social recognition of its people. However, today's genealogy has gradually lost its original social significance and is more inclined to record the identity of members in the core family.

The changes in the nature of a genealogy can be seen from the position it is placed. In 1994, everyone began to put their genealogies on shelves. They were no longer placed on an altar and given offerings. In 2016, many people took their genealogies home and put them in warehouses, and some genealogies were lost. Only a few versions of the manuscript were unchanged, locked in a wooden box, and still placed next to the ancestral

tablet, receiving incense offerings day and night.

The economic and social changes since the establishment of New China have had a huge impact on the clan system, completely depriving the legitimacy of the clan in terms of economy, politics, and culture, and the clan no longer exists in its original form [18]. In the past, the small and comprehensive social organization model also caused the entire society to be divided into cells. Individuals have a sense of belonging in these cells, and it is difficult for people to exist without cells, but there is a lack of interaction between cells. This results in people depending a lot on their clans [19]. However, through collective transformation, the concepts of equality, state, and citizenship have gradually penetrated the people's minds. There is no longer a hierarchy within a family, and everyone is equal. Since the reform and opening up, marketization and industrialization, economic differentiation, occupational division, and regional separation have led to a shift in farmers from homogeneity to heterogeneity, and the blood community has gradually disappeared.

Under the influence of these factors, the clan transformed from a strict social organization into a blood community of "equality for all," and was further divided into several core families under the impact of modernization. On one hand, individuals' and families' dependence on clans has decreased, and individuals have gradually been separated from the locality and integrated into the modern state and market system, leading to the dissipation of the sanctity of clans. On the other hand, the preservation of local society and acquaintance communities has resulted in the preservation of a certain degree of commonality within the clan. Hence, even as the genealogy loses its sacred status within the clan and becomes less effective in controlling clan society, it still holds a significant place in the lives and meaning world of middle-aged and elderly individuals, and a degree of publicity remains.

5. Conclusion

By studying the changes in the content and compilation methods of the genealogies of the S clan in three periods, we can trace the transformation of clans. This evolution applies to genealogies and other forms of clan artifacts. Although the sacredness of genealogies has eroded, they still have some publicity. The genealogy has turned from a sacred item that is worshipped into a platform for showcasing financial capabilities. In the past, the genealogy carried the most important values and meanings of the clan. However, genealogies are now gradually transforming into one of the tools for demonstrating class distinctions within clans, and this transformation in nature and function is definitely worth thinking about.

Funding

The 2023 Jiangxi Provincial Social Science Foundation Project "Research on the Course and Experience of the Communist Party of China in Resolving the Conflict between Indigenous and Immigrant Peoples in Jinggangshan from the Perspective of Social Governance Modernization" (Project number: 23DJ24D)

Disclosure statement

The author declares no conflict of interest.

References

[1] Wang S, Chen Y, 2004, From Kinship to Citizenship: A Study of Rural Lineages in Anhui under the People's

Republic. Social Sciences in China, 2004(1): 180–193.

[2] Zhu Y, Lin P, 2016, The Intergenerational Differentiation and Young People's Interest Appeal in the Clan's Family Tree Compilation. Youth Studies, 2016(6): 60–68.

[3] Liu J, 2018, Viewing the Decline of Modern Clan Society by Comparing the Content of Old and New Genealogy-Taking the Three Clans in Sihui City of Guangdong as the Examples. Qinghai Journal of Ethnology, 2018(3): 211–216.

[4] Liu X, 1993, The Change of Women's Status in Modern Genealogy: A Case Study of C County in Southern Zhejiang Province. Journal of Chinese Women's Studies,1993(4): 43–48.

[5] Wang R, Zhang X, 2008, From Cemetery to Genealogy to Ancestral Temple: The Changing Form of Family Bonds in Qixia Shandong Province during the Ming and Qing Dynasties. Historical Research, 2008(2): 75–97.

[6] Feng E, 2009, The Characteristics and Reasons of Continuous Compilation of Genealogies by Clans: Taking the Compilation of Genealogies by Qing Dynasty People as an Example. Journal of Huaiyin Teachers College (Social Sciences Edition), 2009(5): 638–647.

[7] Pan G, 2000, Collected Works of Pan Guangdan (Volume 1), Peking University Press, Beijing, 114 + 153.

[8] Qian H, 2009, Introduction to the Study of Chinese Clan History, Fudan University Press, Shanghai, 172.

[9] Setagawa M, Qian H, 1999, Genealogy: The Genealogy of Han Chinese in South China, Feng Shui, and Migration. Shanghai Bookstore Publishing House, Shanghai, 292.

[10] Lin Y, 2003, Lectures on Social Anthropology, Lujiang Publishing House, Xiamen, 349.

[11] Zhang J, 2009, Sacred Space and Belief, Fujian Tribune, 2010(7): 45–51.

[12] Fei X, Complete Works of Fei Xiaotong (Volume 5), Inner Mongolia People's Publishing House, Hohhot, 468.

[13] Feng E, 2005, Clans, Villages, and Autonomy in the Qing Dynasty. Journal of Henan Normal University (Philosophy and Social Sciences Edition), 2005(6): 11–13.

[14] Morris F, 2000, Clan Organizations in Southeast China [Trans. Liu X], Shanghai People's Publishing House, Shanghai, 3–4.

[15] Xu L, 1990, Clan, Caste, Club, [Trans. Xue G], Huaxia Publishing House Beijing, 167.

[16] Qian H, 2011, Study on Post Hineage Group. Journal of China Agricultural University (Social Sciences), 2011(4): 80–84.

[17] Liu J, 2018, Viewing the Decline of Modern Clan Society by Comparing the Content of Old and New Genealogy-Taking the Three Clans in Sihui City of Guangdong as the Examples. Qinghai Journal of Ethnology, 2018(3): 211–216.

[18] Yang S, Liu X, 2005, Several Theoretical Problems Related to Current Studies of Chinese Rural Clans, Social Sciences in China, 2005(5): 83–90.

[19] Zhao L, 1998, Family and Village Politics: A Study on the Phenomenon of a Village Family in Hebei, master's thesis, Peking University.

Publisher's note

Bio-Byword Scientific Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Scientific and Social Research, 2023, Volume 5, Issue 10
https://ojs.bbwpublisher.com/index.php/SSR

Research on the Application of Big Data in Retirement Service Management

Xiao Huang[1]*, Yi Zhuang[1], Xiuyu Hu[2], Gang Yu[1]

[1]State Grid Zhejiang Electric Power Co., Ltd., Hangzhou 310000, China
[2]Zhejiang Huayun Information Technology Co., Ltd, Hangzhou 310000, China

***Corresponding author*:** Xiao Huang, 762294382@qq.com

Copyright: © 2023 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

Abstract: In view of the rapid development of China's socio-economy, the field of science and technology has also ushered in new development opportunities. Various modern information technologies have found extensive application in diverse societal sectors and various aspects of people's daily lives. The most representative and widely used technology among them is big data. The 21st century presents not only an era dominated by information technology but also a growing challenge of an aging population in China. Consequently, there is a considerable journey ahead in terms of managing services for retirees. It is imperative to firmly establish the right mindset regarding the internet and big data concepts. Actively exploring diverse information technology applications in the service management for retired individuals and fostering innovative work models can lead to significant enhancements in service quality and efficiency. Therefore, this article presents a study on the application of big data Internet technology in the management of retirement services.

Keywords: Retirement service management; Big data Internet technology; Application strategy

Online publication: October 20, 2023

1. Introduction

Amidst the rapid economic and social advancement in China, the challenge of population aging is growing more pressing. As far back as the close of 1999, China had already begun transitioning into an aging society. According to the latest statistics, the number of elderly people aged 60 and above in China has reached nearly 250 million, accounting for nearly 17.5% of the total population. China has become the only country in the world with an elderly population exceeding 200 million [1]. Faced with this trend, most retirees have undergone significant changes in their living environment, physical fitness, psychological gap, etc. after leaving their work positions, which to some extent increases the difficulty of managing retirement services. Therefore, measures need to be taken to improve the management of retirement server, so as to provide higher quality services for retired personnel.

2. Problems in the management of retirement services

2.1. Thoughts of retirees impacted by a massive amount of information

Although most retirees are in a "second tier" state in their work positions, there are still many people who are

concerned about the development status and future direction of the country and the unit. In recent years, due to the advancement and widespread application of the Internet in China, especially mobile internet, information dissemination and acquisition have become much more efficient. However, this also cause the spread of false and harmful information in the network, which can confuse the public [2]. As retirees are usually under long-term home care, they often become disconnected from the activities of their former workplaces and party organizations. Consequently, their perspectives may be influenced to some degree by negative information, leading to cognitive biases. These biases can pose challenges in managing retirement services.

2.2. Certain changes in life philosophy

Thanks to the rapid advancement of China's economy and society, the living standards of the majority of people continue to rise. Most retirees in our country have endured challenging times during their youth. However, as their economic situation and quality of life keep getting better, their expectations for the content, style, and facilities of their retirement life are shaped by various factors and continue to grow [3]. Some of them have started to pursue healthy lifestyles and high-level spiritual and cultural activities.

2.3. Increasingly diverse interests and demands

It was clearly stated during the 19th National Congress of the Communist Party of China that the primary contradiction in contemporary Chinese society has evolved into the disparity between the people's increasing aspirations for an improved quality of life and the imbalances and inadequacies in development. Retired personnel in China live in various locations with diverse characteristics, and they frequently engage in outdoor activities. Therefore, the services required are becoming increasingly personalized and diverse. Moreover, factors like advanced age and a higher disease prevalence have increased the complexity of retirement service management. Consequently, addressing this emerging trend, improving retirement service management through big data and the Internet has become the primary focus of retirement service management centers.

3. Application strategy of big data Internet technology in retirement service management

As China transitioned from the industrial era to the information age, professional economists widely concur that, in the 21st century, modern information technologies have emerged as the primary driver in various industries. They have also become a crucial material and technological underpinning in the context of the information age. With the widespread use of big data and internet technology across various aspects of society, the adoption of information technology has become a primary focus in various fields. It has become evident that utilizing these technologies in retirement service management is essential. This not only streamlines information collection for retirees but also improves the quality and efficiency of retirement service management. This is particularly important for strengthening and enhancing the management of retirement services in the new environment.

3.1. Comprehensively enhancing the ideological and political leadership of retired party organizations through information technology

The report on the work of the 19th National Congress of the Communist Party of China clearly states that the overall requirements for party building in the new era should be based on strengthening the party's political construction [4]. Retirees include some party members, and these retired members (retired party branch) are an important component of the grassroots party organization. Therefore, retirement service management centers

should fully utilize big data to strengthen the informatization of the retired party branch. Rather than relying solely on traditional methods like newspapers, propaganda boards, magazines, and work conferences for party building, it is essential to embrace internet thinking and harness information platforms, computer technology, and mobile devices. These modern tools should be used to establish a party building service platform for the retirement service management center, significantly expanding party building activities.

For instance, the staff can create WeChat groups specifically for retired party members, gradually guiding the senior party members to use these groups as platforms for expressing their support, protection, concerns, and promotion of the party. To address challenges related to poor vision, hearing, and memory among retirees, retirement service management centers can employ technical software such as WeChat mini-programs and iFlytek Quick Reading to read articles for them. This approach ensures retirees not only have access to illustrated and text-based articles but also enables them to listen to the content, making learning more convenient. Additionally, it facilitates on-site learning services, expanding the educational opportunities for retired individuals from in-person to online. This effectively addresses the issue of mobility-impaired retirees who cannot participate in centralized offline learning activities.

3.2. Establish a service management model for real-time information transmission and guide retirees to form positive thinking

In the context of the information technology era, the channels of information dissemination have become increasingly diverse. However, this has resulted in the spread of false and harmful information.

Some retirees exhibit a strong sense of self-reliance, often giving credence to unofficial information, which can lead to misinterpretation of policies created by government and party entities, resulting in various forms of discontent with society. To address this issue, retirees service management centers can utilize big data internet technology, known for its rapid information dissemination, robust two-way interaction, and minimal geographical limitations. This can be used to create and enhance the retirees' service management network and official accounts. These platforms can actively communicate the latest party policies, work procedures, and guidelines to retirees, reinforcing their political and ideological guidance. This approach maximizes the assistance in ensuring retirees gain an objective and fair understanding of various social events and development challenges [5].

3.3. Utilizing big data increase the efficiency of service management

First, it is crucial to innovate and enhance the information management database for retirees. This involves regularly updating and backing up the databases containing information on retired individuals, retired party members, officials, and their physical health. This ensures a reliable data source for future retirement service management. Secondly, network operation knowledge training activities should be organized and conducted by the Retirement Service Management Center. This should include regular sessions on operational knowledge, covering areas such as the Internet and WeChat, to ensure that retirees understand of common software. Thirdly, emphasis should be placed on the integration of offline and online services. For instance, the collection of party fees can be executed through WeChat groups. In cases where party members have not promptly submitted their party fees, they or their family members can forward the fees to the party branch via the WeChat group. Subsequently, the party branch can relay these payments to higher-level party organizations.

3.4. Using big data to build a positive energy platform

Firstly, the work experience and intelligence of retirees should be acknowledged. Retirement service centers can actively encourage retired personnel to provide suggestions to promote reform and development. By leveraging WeChat participation in initiatives like "Embracing Change, I Advocate for Development" and

"Local Development Gold Ideas," we can gather feedback and input from retirees regarding the party's leadership, party culture, clean governance, reform, development, and social modernization. This encourages retired individuals to actively contribute and remain engaged in these areas [7]. Secondly, use the party building app or WeChat public account to organize online virtual party branch activities to learn the leader's new era of socialist ideas with Chinese characteristics, major party-political theoretical policies, the party's major political theory, and knowledge of party building. Thirdly, the online environment should be cleansed, with an increased recruitment of retirees who possess a comprehension of the law and internet use for participation in online publicity efforts. This entails reinforcing the promotional and instructive role of mainstream media.

4. Conclusion

In summary, it is essential and imperative to reform and innovate the management of retired personnel in the contemporary era, emphasizing the deep integration of big data. This serves as a pivotal approach for retirement service management centers to proactively adapt to changing times, elevate the standard of service management and work quality, and effectively address the challenges stemming from China's aging population. Hence, retirement service management centers, regardless of their regional or organizational nature, should align with the evolving landscape, comprehensively acknowledge the role of big data in retirement service management, and expand its application based on practical circumstances. This approach enhances the quality of retirement service management, ultimately realizing the objective of "empowering data while simplifying retirees' roles."

Disclosure statement

The author declares no conflict of interest.

References

[1] Liu M, 2023, How to Do a Good Job in Managing Retirement Services, Shanxi Market Guide, September 5, 2023, (C02).

[2] Qin R, 2022, How to Do a Good Job in the Management and Service of Retirees: A Case Study of Bohai Shipbuilding Vocational College. Liaoning Journal of Vocational Education, 2022(8): 103–107.

[3] Hu S, 2022, Innovation in Service Management of Retired Cadres from the Perspective of Human Resources Management. Modern Commerce and Industry, 43(13): 76–77.

[4] Guo L, Tian J, Sun Y, 2022, Exploration and Practice of Doing Well in the Management of Retirement Services in Enterprises Under the New Situation. Modern Enterprise Culture, 2022(11): 148–150.

[5] Yang Y, 2021, Difficulties and Countermeasures in Enterprise Retirement Management Services. Vitality, 2021(23): 165–166.

[6] Wang S, 2021, New Thoughts on Service Management for Retired Employees of State-Owned Enterprises in the New Era. China Collective Economy, 2021(6): 58–59.

[7] Xing C, 2020, Research on the Service Management of Retired Cadres in the Aksu Region in the New Era, dissertation, Xinjiang Agricultural University.

Publisher's note

Bio-Byword Scientific Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Scientific and Social Research, 2023, Volume 5, Issue 10
https://ojs.bbwpublisher.com/index.php/SSR

Popularizing Science Among the Grassroots: Development, Existing Problems, and Countermeasures

Na Shen[1]*, Xiaodong Duan[2], Yindi Yao[3]

[1]Xi'an Science and Technology Museum, Xi'an 710002, Shaanxi Province, China
[2]Xi'an Science and Technology Exchange Museum, Xi'an 710002, Shaanxi Province, China
[3]Xi'an University of Posts & Telecommunication, Xi'an 710002, Shaanxi Province, China

***Corresponding author:** Na Shen, shennachn@163.com

Copyright: © 2023 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

Abstract: The issue of improving scientific literacy has always been a social concern, and the formation of science communication teams plays an important role in improving scientific literacy. This paper examines the current state of domestic science communication teams, highlights issues in their construction, and offers suggestions for enhancing these teams. These suggestions include developing a sound management system, strengthening industry communication, enhancing public services, and drawing upon the management expertise of other science communication venues.

Keywords: Science communication; Scientific literacy; Science education

Online publication: October 20, 2023

1. Introduction

The cultivation of science popularization talents and the forming of science communication teams are crucial to the improvement of public scientific literacy. General Secretary Xi Jinping has emphasized the importance of the work of enhancing the public's scientific quality in many public speeches, and General Secretary Xi pointed out that "scientific and technological innovation and popularization of science are the two wings of realizing innovative development, and popularization of science should be put on the same important position as scientific and technological innovation" [1]. To further enhance public scientific literacy, Shaanxi Province and Xi'an City have successively issued the "Action Plan for Enhancing Scientific Literacy (2021–2035)." The shortage of science communicators, disorganized team structures, and low specialization impede the development of science popularization talent, rendering their role ineffective [2,3]. Therefore, this paper examines the current state of domestic science communication teams, highlights issues in their construction, and offers suggestions for enhancing these teams within the context of science and technology museums. These suggestions include developing a sound management system, strengthening industry communication, enhancing public services, and drawing upon the management expertise of other science communication venues.

2. Status of science communication teams in China

In 2002, the "Science Popularization Law of the People's Republic of China" was promulgated and implemented, which was crucial for the popularization of science in our country [4]. In March 2006, the State Council issued the "Action Plan for Enhancing Scientific Literacy (2006–2020)" which outlined the direction for promoting scientific literacy over the next 15 years. Under the idea of "government promotion, public participation, improvement of quality, and promotion of harmony," comprehensive efforts were made to enhance the scientific literacy of the people [5]. The goal was to achieve significant development in scientific and technological education, communication, and popularization by 2020. This included creating a comprehensive system for organizing, implementing, infrastructure development, ensuring necessary conditions, monitoring, and assessing the scientific literacy of citizens [6]. With these measures, the scientific literacy of citizens would be greatly improved, reaching the level of major developed countries. Key projects included foundational projects for science education and training, the creation and dissemination of science communication resources, building mass media science and technology communication capabilities, and advancing science communication infrastructure. According to national science communication statistics in 2020, the scientific literacy of Chinese citizens reached 10.56 %, and the talent pool for science communication began to take shape [7].

In June 2021, the State Council released the "Action Plan for Enhancing Scientific Literacy (2021–2035)," which proposed building a comprehensive and effective system for improving citizens' scientific literacy. This system would be diverse in subjects and means, offer high-quality resources, and establish effective mechanisms [8]. By 2025, the scientific literacy of China is expected to reach 15%; and by 2035, it is expected to reach 25%. Key projects include the dissemination of scientific and technological resources, the enhancement of information technology in science communication, the development of science communication infrastructure, the improvement of grassroots science popularization capabilities, and international exchanges and cooperation in scientific literacy [9]. According to national science popularization statistics in 2022, the proportion of Chinese citizens with scientific literacy reached 12.93%, indicating the continuous development and growth of the science communication talent pool.

Over the past 20 years, with the "Science Popularization Law of the People's Republic of China" and other relevant documents as guidance, diverse departments, organizations, and society have actively engaged in mass science popularization activities. These efforts have yielded a series of achievements in science popularization within our country, leading to a consistent improvement in the overall scientific literacy of the public [10].

3. Problems in the construction of science communication teams

3.1. The stark difference between the planning of science communication team construction and the actual situation

Domestic focus on building science communication teams is evident through a range of public policies, and theoretical understanding continues to advance. Nevertheless, practical issues persist.

Table 1. History of China's science communication planning development

Content	Policy requirements	Reality
Team formation	Establishing a well-structured team with proficient management, a skilled professional and technical workforce, and an innovative and dynamic high-end research team.	Lack of professional and technical talents. As of 2021, about 1,827,500 people are engaged in science communication across the country, of which 22,400 are full-time scientific content creators and 49,200 are full-time science interpreters

Table 1 (continued)

Content	Policy requirements	Reality
Talent management system	Implementing a tiered talent management system, enhancing position grading and classification standards, and creating and executing personalized career development plans for staff.	There is no established popular science title series, and a unified and scientific professional and technical title system has not been developed.
Talent training channels	Creating proper talent training channels and innovating talent training mechanisms	Universities have yet to set up science communication programs and establish a standardized talent training system

Data source: National Science and Technology Statistics 2021

3.2. Science communication venues are still in the process of exploring the construction of science communication teams

In 2002, the "Science Popularization Law of the People's Republic of China" was promulgated and implemented, and the work of improving the scientific literacy of our country began with the promulgation of relevant policies [11]. Subsequently, relevant policies were issued in 2006. In March 2006, the State Council issued the "Action Plan for Enhancing Scientific Literacy (2006–2020)." In June 2021, the State Council released the "Action Plan for Enhancing Scientific Literacy (2021–2035)." These policies have encouraged the development of science communication venues and the establishment of science communication teams [12].

Table 2. Development of China's science communication talent nurturing system

Period	Content of focus	System
Initial exploration stage: 2002–2006	Science communication venues built with government financial investment were equipped with necessary full-time personnel	Only requirements of full-time staff were outlined, rather than establishing a comprehensive system for building a science communication team.
The development stage: 2006–2020	Strengthening the construction of the teaching force, cultivating a team consisting of both full-time and part-time. The teams were reasonably structured the team members were competent	A two-tiered approach was implemented, connecting the development of science communication talent with that of science communication educators to create an initial cultivation system.
Mature stage: 2021–present	Promoting the robust development of a full-time science communication talent team across various sectors, including science communication venues, science centers, science and technology publishing, new media, and research. Encouraging higher education institutions, research organizations, and businesses to create science communication positions. Formulating a college and university alliance for nurturing science communication talents, enhancing the training of expert science communicators, and supporting the establishment of science communication programs.	A multi-level strategy was adopted, specifying the construction requirements for a science communication talent team and mandating the formation of talent management and training systems.

3.3. Increased public expectation of science communicators

As scientific literacy advances, the science communication talent team must adapt. The public, once passive recipients of information, now seeks interactive engagement with communicators who possess professional backgrounds, modern education expertise, and the skills to convey comprehensive and in-depth scientific knowledge [13]. The public's expectations of science communicators are mainly reflected in the following aspects. (1) Professional knowledge: Science communicators are expected to have professional knowledge

and to be able to provide true and accurate scientific knowledge to them. Every science communicator should have a wide range of knowledge of their field so that they can convey their knowledge to the general public. (2) Ability to educate people [14]: Science communicators are expected to have good teaching skills, and to be able to convey complex scientific knowledge to them in a simple way. They should be able to express themselves well and understand the cognitive level and the needs of the public so that they can convey scientific knowledge to them effectively. (3) Creativity: Science communicators should have innovative skills so that they can create new ways of scientific communication and improve the efficiency and quality of scientific knowledge [15]. Science communicators must stay attuned to scientific frontiers, grasp emerging fields and technologies, and foster innovative approaches in science communication. Furthermore, the science communication team should embody a sense of purpose, demonstrating dedication and a willingness to contribute positively toward the advancement of science and culture dissemination [16]. Obviously, the simplistic, unsystematic way of training science communicators in the past is no longer applicable due to the growing demands of the people.

4. Research on countermeasures

4.1. Establishing a sound management and supervision system

In recent years, the cultivation of science communicators has not only been based on theoretical guidance but also driven by practical needs. Through continuous practice, valuable experience has been gained, and various regions have paid attention to and provided suggestions for effective strategies in building such talent teams. In 2018, Beijing issued the "Opinions on Deepening the Reform of the Professional Title System," which clearly proposed the establishment of a professional title for science communication. In 2019, Beijing granted its initial set of senior professional titles in science communication. In 2020, a comprehensive evaluation of senior, intermediate, and junior professional titles in science communication was conducted [17]. The reform of the professional title system in science communication in Beijing has served as a model, inspiring provinces and cities like Tianjin, Henan, Gansu, Zhejiang, and Anhui to adopt professional title systems for science communication. Notably, in 2023, the China Association for Science and Technology released a notice initiating the evaluation of professional titles in natural science popularization for central units in Beijing, an effort aimed at encouraging science communication professionals to play a more significant role.

4.2. Establishing industry organizations to enhance communication and exchange

Establishing a science communication venues alliance has become a shared goal among science communication professionals. This initiative not only fosters synergy and resource sharing among popular science venues, including exhibits and teaching materials, but also encourages inter-industry collaboration. It elevates the development of science communication talent teams by enhancing industry communication. For example, a high-end science communication forum can be carried out to encourage practitioners to speak freely and obtain detailed data, so that the talent cultivation system can be improved [18]. This will help create a system for science communication venues to communicate and share resources effectively, which is a key factor in building a strong team of science communicators.

4.3. Making science communication people-oriented

Science communication is a way of teaching science to the public and spreading scientific knowledge to improve scientific literacy. In the current era of informatization, the role of science communication is becoming more and more important, because it can enhance the public's knowledge and understanding of science, thus promoting the development of science and technology and social progress [19]. However, science communication

has to be more personalized and people-oriented in order to achieve sustainable development. Personalized science education means that educators are able to tailor the content and form of science education to the needs and characteristics of different groups. Educators should adjust to the diverse interests, routines, and knowledge levels of the public. They should customize science education programs to make them more engaging and useful. Differentiated popular science education means that educators innovate educational forms to make popular science education more personalized and diversified. Science communication can be done in various ways like games, interactive science exhibitions, science classes, etc [20]. By constantly innovating and improving the forms of science communication, more people will be interested in science and technology. Sustainable science education means creating a lasting system that ensures the stable and ongoing progress of science education. Educators should enhance coordination, build a network of science education across different sectors and levels, and assume a primary role in science education. This will enable the continued development of education efforts. As more scientists devote themselves to science communication, it will bring a qualitative leap for the popularization of science. Scientists will guide the majority of science communicators to improve the quality of their work from in terms of education and scientific research. The stronger the talent pool, the more robust the science communication efforts, and the better they can meet the public's demand for increasing scientific literacy.

5. Conclusion

It can be seen that the development of science communication team building in China has undergone a long process, with the content expanding from the cultivation of science communicators to the research and construction of science communication teams. People have realized the importance of informal learning in promoting public scientific literacy. Therefore, it is necessary to improve the construction system of science communication teams by perfecting the management system, strengthening industry communication, and enhancing public services.

Funding

This work was funded by the 2023 Xi'an Science Popularization Special Funds Project titled "Empirical Research on the Performance Evaluation of Science Communicators in Science and Technology Museums from the Perspective of Demand Analysis."

Disclosure statement

The authors declare no conflict of interest.

References

[1] Zhang RK, Wang MC, 2021, Research on the construction of Shanghai Science Popularization talents during the 14th Five-year Plan period. Popular Science Research, 16(6): 42–49 + 114.

[2] Yamagishi K, Seki K, Nishimura H, 2018, Requirement Analysis Considering Uncertain Customer Preference for Kansei Quality of Product. Journal of Advanced Mechanical Design, Systems, and Manufacturing, 12(1): 1–13.

[3] Wang M, 2022, Empirical Study on Operational Assessment of Science and Technology Museums. Research on Natural Science Museum, 2022(4): 52–62.

[4] Li P, Su G, Liu H, 2022, Status Quo and Development Countermeasures of Science Popularization Carrier Construction in the New Era. Henan Science and Technology, 41(1): 138–141.

[5] Liu Q, 2022, Research Status and Development Countermeasures of Science and Technology Museum Standardization. Natural Science Museum Research, 2022(3): 60–66 + 94–95.

[6] Wang Z, Li J, Wang S, 2021, Research on the Current Situation and Countermeasures of Science Popularization Talent Team Construction in Tianjin. Tianjin Science and Technology, 48(6): 5–8.

[7] Pan X, 2021, Current Situation and Development Strategy of Science Popularization Talents in China. 2021(8): 32–34.

[8] Yuan M, Zhou J, 2021, Research and Thinking on the Construction of Science Popularization Talents in the New Era. Science Popularization Research, 16(6): 18–24 + 112–113.

[9] Li G, Wang F, Long Z, 2020, Countermeasures of Author Team Construction Under the New Demand of Popularization of Science. Publishing Science, 2020(1): 48–52.

[10] Zhao D, Gao H, Zhao L, 2020, Problems and Countermeasures in the Development of Science Popularization Talents in China. Science and Technology Herald, 38(5): 92–98.

[11] Xu M, 2019, Research on the Optimization of the Realization Path of Science Education Function of Large-Scale Science Popularization Venues in China: Taking Shanghai Science and Technology Museum as an Example, dissertation, Shanghai Normal University.

[12] Xu S, 2018, Management and Procedure of Content Construction of Science and Technology Museum. Science Education and Museum, 4(6): 364–366.

[13] Zhu H, 2018, Talking About the Construction of Science Popularization Personnel Team from the Perspective of Science Popularization System. Science and Technology Communication, 10(20): 186–187.

[14] Zhang W, Zhang X, 2018, On the Construction and Cultivation of Science Popularization Personnel Team in Colleges and Universities. Modern Vocational Education, 2018(23): 37.

[15] Xu S, 2017, Reflections on Science Museums in Europe, the United States, and Japan. Science Education and Museum, 3(4): 315–316.

[16] Sun N, Lan H, Zhang L, et al., 2017, Countermeasures Thinking on the Construction of Science Popularization Talent Team in the New Period. Industry and Technology Forum, 16(1): 278–279.

[17] Bai Y, 2017, Research on the Problem of Science Popularization Talent Cultivation in Science and Technology Museums Under the Perspective of Demand Analysis Theory: Taking Shanghai Science and Technology Museum as An Example, dissertation, Shanghai Normal University.

[18] An Q, 2011, Design of Performance Appraisal System For Employees of Science and Technology Museums: Taking Tianjin Science and Technology Museum as an Example, dissertation, Tianjin University.

[19] Zhou YH, 2015, Demand Forecasting of Public Welfare Jobs and its Effect Analysis: A Case Study of Urumqi City, Xinjiang. Journal of Xinjiang University, 2015(1): 19–23.

[20] Chen H, 2006, Science Popularization Education in Modern China, dissertation, East China Normal University.

Publisher's note

Bio-Byword Scientific Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Integrated Services Platform of International Scientific Cooperation

Innoscience Research (Malaysia), which is global market oriented, was founded in 2016.Innoscience Research focuses on services based on scientific research. By cooperating with universities and scientific institutes all over the world, it performs medical researches to benefit human beings and promotes the interdisciplinary and international exchanges among researchers.

Innoscience Research covers biology, chemistry, physics and many other disciplines. It mainly focuses on the improvement of human health. It aims to promote the cooperation, exploration and exchange among researchers from different countries. By establishing platforms, Innoscience integrates the demands from different fields to realize the combination of clinical research and basic research and to accelerate and deepen the international scientific cooperation.

Cooperation Mode



Clinical Workers



In-service Doctors





Foreign Researchers





Hospital



University



Scientific institutions

BIO-BYWORD
SCIENTIFIC PUBLISHING PTY LTD

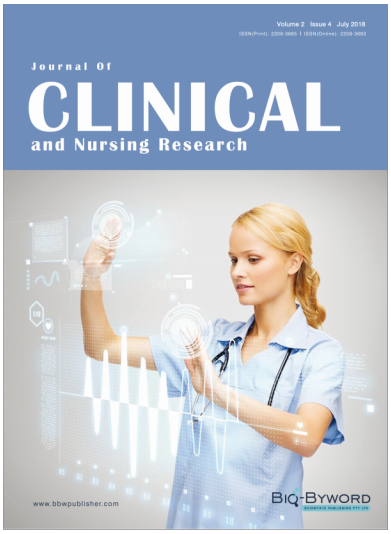
OUR JOURNALS



The *Journal of Architectural Research and Development* is an international peer-reviewed and open access journal which is devoted to establish a bridge between theory and practice in the fields of architectural and design research, urban planning and built environment research.

Topics covered but not limited to:

- Architectural design
- Architectural technology, including new technologies and energy saving technologies
- Architectural practice
- Urban planning
- Impacts of architecture on environment



Journal of Clinical and Nursing Research (JCNR) is an international, peer reviewed and open access journal that seeks to promote the development and exchange of knowledge which is directly relevant to all clinical and nursing research and practice. Articles which explore the meaning, prevention, treatment, outcome and impact of a high standard clinical and nursing practice and discipline are encouraged to be submitted as original article, review, case report, short communication and letters.

Topics covered by not limited to:

- Development of clinical and nursing research, evaluation, evidence-based practice and scientific enquiry
- Patients and family experiences of health care
- Clinical and nursing research to enhance patient safety and reduce harm to patients
- Ethics
- Clinical and Nursing history
- Medicine



Journal of Electronic Research and Application is an international, peer-reviewed and open access journal which publishes original articles, reviews, short communications, case studies and letters in the field of electronic research and application.

Topics covered but not limited to:

- Automation
- Circuit Analysis and Application
- Electric and Electronic Measurement Systems
- Electrical Engineering
- Electronic Materials
- Electronics and Communications Engineering
- Power Systems and Power Electronics
- Signal Processing
- Telecommunications Engineering
- Wireless and Mobile Communication