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Front Pages

Athens Journal of Health and Medical Sciences

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The ***Athens Journal of Health and Medical Sciences (AJHMS)*** is an Open Access quarterly double-blind peer reviewed journal and considers papers from all areas of medicine (including health studies and nursing research). Many of the papers published in this journal have been presented at the various conferences sponsored by the Health & Medical Sciences Division of the Athens Institute for Education and Research (ATINER). All papers are subject to ATINER's Publication Ethical Policy and Statement.

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Athens Journal of Health and Medical Sciences
Editorial and Reviewers' Board

President's Message

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The current issue is the second of the eleventh volume of the *Athens Journal of Health and Medical Sciences* (AJHMS), published by the **Health & Medical Sciences Division of ATINER.**

Gregory T. Papanikos
President
ATINER

Athens Institute for Education and Research

A World Association of Academics and Researchers

23rd Annual International Conference on Health Economics, Management & Policy, 24-27 June 2024, Athens, Greece

The Health Economics & Management Unit of ATINER will hold its **23rd Annual International Conference on Health Economics, Management & Policy, 24-27 June 2024, Athens, Greece s**ponsored by the Athens Journal of Health and Medical Sciences. The aim of the conference is to bring together academics, researchers and professionals in health economics, management and policy. You may participate as stream leader, presenter of one paper, chair of a session or observer. Please submit a proposal using the form available (https://www.atiner.gr/2024/FORM-HEA.doc).

Academic Members Responsible for the Conference

- **Dr. Paul Contoyannis**, Head, Health Economics & Management Unit, ATINER & Associate Professor, McMaster University, Canada.
- **Dr. Vickie Hughes**, Director, Health & Medical Sciences Division, ATINER & Assistant Professor, School of Nursing, Johns Hopkins University, USA.

Important Dates

- Abstract Submission: **DEADLINE CLOSED**
- Acceptance of Abstract: 4 Weeks after Submission
- Submission of Paper: **27 May 2024**

Social and Educational Program

The Social Program Emphasizes the Educational Aspect of the Academic Meetings of Atiner.

- Greek Night Entertainment (This is the official dinner of the conference)
- Athens Sightseeing: Old and New-An Educational Urban Walk
- Social Dinner
- Mycenae Visit
- Exploration of the Aegean Islands
- Delphi Visit
- Ancient Corinth and Cape Sounion
    - More information can be found here: https://www.atiner.gr/social-program

Conference Fees

Conference fees vary from 400€ to 2000€
Details can be found at: https://www.atiner.gr/fees

Athens Institute for Education and Research

A World Association of Academics and Researchers

13th Annual International Conference on Health & Medical Sciences
5-8 May 2025, Athens, Greece

The Medicine Unit of ATINER is organizing its **13th Annual International Conference on Health & Medical Sciences, 5-8 May 2025, Athens, Greece** sponsored by the Athens Journal of Health and Medical Sciences. The aim of the conference is to bring together academics and researchers from all areas of health sciences, medical sciences and related disciplines. You may participate as stream leader, presenter of one paper, chair a session or observer. Please submit a proposal using the form available (https://www.atiner.gr/2025/FORM-HSC.doc).

Important Dates

- Abstract Submission: **1 October 2024**
- Acceptance of Abstract: 4 Weeks after Submission
- Submission of Paper: **7 April 2025**

Academic Member Responsible for the Conference

- **Dr. Vickie Hughes**, Director, Health & Medical Sciences Research Division, ATINER & Assistant Professor, School of Nursing, Johns Hopkins University, USA.
- **Dr. Carol Anne Chamley**, Head, Nursing Research Unit & Associate Professor, School of Health and Social Care, London South Bank University UK.
- **Dr. Andriana Margariti**, Head, Medicine Research Unit, ATINER & Lecturer, Centre for Experimental Medicine, Queen's University Belfast, U.K.

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Athens Journal of Health & Medical Sciences – Volume11, Issue 2, June 2024 – Pages 67-78

Internet and Social Media Impact on Health and COVID-19 in Puerto Rico

By Ivan De la Cruz[*]

This paper analyzes the impact of social media and Internet in relation to health and COVID-19 in Puerto Ricans from the Information Society perspective, including the impact on patient-to-doctor relationship and health services demand, impact on patient-to-patient relationship, knowledge and understanding of information and Internet impact factors in relation to health. An online survey of 124 cases confirmed its effects on the doctor and patients.

Keywords: *social media, doctor, patient, Internet, COVID-19*

Introduction

In this study analyzing the impact of social media and the internet on health and COVID-19 among Puerto Ricans from the perspective of the information society, we explore how the use of these platforms for health information affects public knowledge of COVID-19 and its relationship with physicians and other patients.

The objective of this study was to identify and characterize the perceptions of internet users in Puerto Rico regarding the use of social media and the internet for health-related purposes, the doctor-patient relationship, the patient-patient relationship, and health knowledge.

We begin with this introduction and then delve into the following topics: the impact on the doctor-patient relationship and the demand for health services, the impact on the patient-patient relationship, and knowledge and comprehension of health information.

Literature Review

Social media initially served as a platform for sharing personal and familial experiences and information among friends, family, and acquaintances. Over time, these platforms have evolved into hubs for the exchange of diverse information on various topics. The Internet has become an increasingly vital resource for individuals seeking health information. Notably, around 60% of Internet users search for health-related information for personal use (Atkinson et al. 2009).

In the healthcare sector, social media platforms are utilized to facilitate communication among professionals and between professionals and patients. Additionally, they are leveraged for promoting institutional branding and enhancing

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the speed of interaction within and across different healthcare domains (Grajales et al. 2014).

The importance of social media extends to emergency and disaster management, as these platforms offer real-time updates, enabling swift and effective responses to evolving situations (Coombs 2016). Particularly during crises like the COVID-19 pandemic, social media's ability to disseminate educational content rapidly has been invaluable (González-Padilla and Tortolero-Blanco 2020).

Another advantage of utilizing social media for communication is its broad reach, encompassing audiences beyond those actively seeking information. This broader dissemination enhances the effectiveness of institutional communication efforts (Mori et al. 2020).

Social media platforms serve as effective tools for promoting COVID-19 prevention behaviors to the public. Health literacy is essential for individual health promotion and influences the extent to which the public engages in preventive behaviors during a pandemic (Li and Liu 2020). However, this requires targeted public information campaigns and the promotion of population health literacy for better navigation of infodemic information environments, identification of disinformation, and decision-making based on reliable and trustworthy information (Okan et al. 2020).

Research by Geldsetzer (2020) revealed significant misconceptions among participants regarding COVID-19, such as the belief that avoiding Chinese restaurants was necessary. Notably, individuals with lower health literacy exhibited higher confusion about coronavirus-related information, underscoring the need for tailored communication strategies (Okan et al. 2020).

This could be a consequence of low exposure to health information, exposure to false information in preferred media, or little interest in adhering to a hygienic regimen. The transmission of moderate to high preventive measures, symptoms, and treatments, in most participants, confirmed that they relied on myths and violated certain preventive measures (Alanezi et al. 2020). However, increased media exposure to the pandemic has positively correlated with adherence to preventive measures, driven by perceived knowledge and fear (Melki et al. 2020).

This relationship between guilt and compliance with social distancing measures is doubly mediated by empathy and responsibility towards people who suffered from COVID-19. This caused part of the population to assume positive behavior and comply with the orders and rules established by governments (Samadara et al. 2020). Tailored communication strategies, such as targeted campaign videos and news articles, have demonstrated efficacy in promoting adherence to preventive measures like thorough handwashing (Yousuf et al. 2020).

In conclusion, social media's role in disseminating health information and promoting preventive behaviors, especially during public health crises, cannot be understated. Addressing misinformation and fostering public understanding through targeted communication strategies are essential for ensuring effective health communication and compliance with recommended guidelines.

Methodology/Materials and Methods

The study's statistical universe comprised the entire population aged 18 to 64 residing in the San Juan Metropolitan Area, totaling 761,842 individuals according to official United States Census data (2020). A sample size of 124 individuals was selected, ensuring a margin of error of 7.5% for the San Juan Metropolitan Area at a confidence level of 90%. Sampling was conducted online using Google Forms, with participation extending beyond the designated metropolitan area to encompass other municipalities in the country. Notably, 42.1% of respondents fell within the 18 to 21 age bracket, with 45.1% possessing a high school or bachelor's degree, and 55.7% reporting an income of less than $15,000 USD, with 69.7% being female.

Results

We began with the question about the use of traditional media to search for health information, and in the "Very frequently" category, it was found that doctors appear first (19.7%), followed by television (15.6%), others (14.8%), press articles (14.8%), advertisements in the press, radio, television, billboards, and others (14%), and friends and family (14%). Table 1 presents the frequency distributions of health information sources.

Table 1. *Health-Related Sources of Information (Percentages)*

Sources	Very often	Often	In Occasions	Rarely	Never
Television	15.6%	9.8%	13.1%	15.6%	18.1%
Radio	5.7%	12.2%	10.6%	19.4%	22.9%
Press Articles	14.8%	15.4%	13.6%	14.5%	12.0%
Magazines	1.6%	5.7%	11.1%	18.3%	18.1%
Advertising	13.9%	9.8%	12.1%	14.5%	10.2%
Friends & Family	13.9%	19.5%	17.1%	5.4%	5.4%
Medical	19.7%	18.7%	16.1%	8.1%	3.6%
Other	14.8%	8.9%	6.5%	4.3%	9.6%

When it comes to using the Internet to search for health information, 66.4% of respondents reported doing so. Among them, 27.9% said they did it sometimes, while 5.7% rarely did, and no one reported never using it. Other media frequently used to search for health information included doctors (34.6%), television (13.4%), advertisements in various media (7.8%), radio (5.5%), newspaper articles (5.5%), magazines (2.8%), and others. Despite the variety of sources, doctors remained the primary source of health information.

On the Internet, health information websites were the most frequently mentioned (78.7%), followed closely by social media (73%) and doctors' websites (70.5%). The most used social networks for health information searches were YouTube (58.2%) and Facebook (50%), followed by Instagram (35.2%), Twitter (17.2%), Quora (5.7%), and Telegram (1.6%), among others. The topics searched

for on Internet pages mainly included illness or medical problems (85.2%), medical treatments or procedures (82.8%), doctors or other professionals (62.3%), hospitals and other facilities (39.3%), and health insurance (23.8%), among others.

On social networks, the topics included illness or medical problems (41%), medical treatments or procedures (39.3%), doctors or other professionals (45.1%), hospitals and other facilities (36.1%), and health insurance (15.6%), among others. While all topics were searched for on both the Internet and social networks, the frequency was generally lower on social networks.

Regarding specific diseases searched for on websites, they included cancer (63.1%), COVID-19 (91.8%), depression, anxiety, or other mental conditions (70.5%), diabetes (45.1%), erectile dysfunction (11.5%), heart disease (36.9%), respiratory diseases (41%), stress (68.9%), high blood pressure (31.1%), and women's health (49.2%), among others.

On social media, the diseases searched for included cancer (27%), COVID-19 (73.8%), depression, anxiety, or other mental conditions (47.5%), diabetes (19.7%), erectile dysfunction (9%), heart disease (16.4%), respiratory diseases (16.4%), stress (47.5%), high blood pressure (12.3%), and women's health (36.9%). Notably, searches about COVID-19 were prominent in both cases, with 91.8% on the Internet and 73.8% on social networks.

Impact on the Doctor-Patient Relationship and the Demand for Healthcare Services

We set out to investigate whether the use of websites and social media to search for health information would have any effect on the demand for health services and therefore on the doctor-patient relationship. The first effect observed is the perception of some improvement in the doctor-patient relationship, due to the fact of being able to share health information found on the Internet and social networks. Participants were asked if they had shared COVID-19 information found online with their doctors. 52.5% indicated never, while 7.4% very frequently, 9.8% frequently, 15.6% occasionally, and 14.8% rarely.

In terms of social media information, 9% very frequently, 7.5% frequently, 13.9% sometimes, 13.9% rarely, and 55.7% never. Participants were asked whether sharing information from the Internet had improved the doctor-patient relationship. 11.5% completely agreed, 28.7% agreed, 42.6% were not sure if the relationship was evolving positively, 9% disagreed, and 8.2% strongly disagreed. Although almost half of the undecided voters are undecided, 40.2% indicate that there has been an improvement. If we analyze the characterization by gender, we find the following (See Table 2).

Table 2. *Characterization of a Certain Perception of Improvement in the Doctor-Patient Relationship due to the Fact of Being Able to Share Health Information Found on the Internet and Social Networks (Percentages)*

Gender	Completely agree	I agree	Undecided	In Disagreement	Strongly disagree
Man	1.6%	6.6%	14.8%	0%	2%
Woman	9.0%	20.5%	14.8%	9%	6%

When we addressed the issue of whether health information about COVID-19 found on websites had led to more questions being asked of the doctor, respondents answered very frequently, 13.1%; frequently, 19.7%; sometimes, 32.8%; rarely, 18.9%; and never, 15.6% of the participants. We asked the same question about COVID-19 information found on social media, and respondents answered very frequently, 12.3%; frequently, 18%; sometimes, 27.9%; rarely, 16.4%; and never, 25.4% of the participants. When contrasting these data, we found that both the information on websites and social networks led them to ask more questions to the doctor, with 31.8% in the affirmative with page data and 30.3% from social media. If we analyze the characterization by gender, we find the following about the information found on web pages (See Table 3).

Table 3. *Characterization of the Health Information Found on Websites had Led to More Questioning of the Doctor (Percentages)*

Gender	Very Frequently	Frequently	Ocassionaly	Rarely	Never
Man	4.1%	4.9%	8.2%	3%	5%
Woman	9.0%	13.1%	23.8%	0%	9%

The gender characterization indicates that women (12.1%) asked slightly more questions to the doctor than men (9%) after having found health information on websites, although the result is very similar. If we analyze the characterization by gender, we find the following about the information found on web pages (See Table 4).

Table 4. *Characterization of the Health Information Found on Social Media had Led to More Questioning of the Doctor (Percentages)*

Gender	Very Frequently	Frequently	Ocassionaly	Rarely	Never
Man	2.5%	4.9%	8.2%	2%	7%
Woman	9.8%	11.5%	18.0%	13%	16%

The gender characterization indicates that women (21.3%) asked slightly more questions to the doctor than men (7.4%) after having found health information on social media.

Internet health data may need to be clarified with a health professional, so patients were asked if the information found on the Internet had motivated them to visit the doctor. When examining these responses, we see that 5.7% answered very frequently, 12.3% said frequently, 26.2% said sometimes, only 23% said rarely, and 32.8% never. We ask the same question about information found on social media. When examining these responses, we see that 4.9% answered very frequently, 8.2% said frequently, 20.5% said sometimes, only 19.7% said rarely, and 46.7% never. When contrasting these data, we see that more visits were generated by web pages than by social networks, with 18% affirmative with page data and 13.1% by social media. If we analyze the characterization by gender, we find the following about the information found on websites (See Table 5).

Table 5. *Characterization of the Information Found on the Internet had Motivated them to Visit the Doctor (Percentages)*

Gender	Very Frequently	Frequently	Ocassionaly	Rarely	Never
Man	0.8%	4.9%	7.4%	5%	7%
Woman	4.1%	6.6%	17.2%	18%	23%

The gender characterization indicates that women (10.7%) asked more questions to the doctor than men (5.7%) after having found health information on websites. There is a chance that there will be people who feel that it is not necessary to go to the doctor if they find the medical information on the Internet. In this regard, we found the following results: 7.4% answered very frequently, 9% said frequently, 32.8% said sometimes, 9.8% said rarely, and 41% never. In the case of information from social networks, the results were: 5.7% answered very frequently, 6.6% said frequently, 24.4% said sometimes, 10.7% said rarely, and 52.5% never. When comparing these data, we did not find much difference between trust placed in websites versus in social networks, with 16.4% in the affirmative with page data and 12.3% on social media.

Impact on the Patient-Patient Relationship

The aspect related to sharing information about COVID-19 with other patients was addressed. The initial inquiry was whether internet users share such information with other patients on social networks. We found that 12.3% answered very frequently, 16.4% said frequently, 28.7% said sometimes, 18% said rarely, and 24.6% never. This suggests that the majority share information at some point. Upon analyzing the characterization by gender, we find the following results (See Table 6).

Table 6. *Characterization of Sharing Information with Other Patients on Social Networks (Percentages)*

Gender	Very Frequently	Frequently	Sometimes	Rarely	Never
Man	0.8%	2.5%	6.6%	5%	11%
Woman	4.1%	5.7%	12.3%	14%	33%

The gender characterization indicates a slightly more extensive tendency among women (9.8%) than men (3.3%) regarding sharing information with other patients on social networks. However, the majority did not engage in this behavior. For those who did share, the question of its benefit was posed. The findings revealed that 22.1% completely agreed, 35.2% agreed, 30.3% were unsure, 5.7% disagreed, and 6.6% completely disagreed. If we analyze the characterization by gender, we find the following results (See Table 7).

Table 7. *Characterization of Sharing Information with other patients on Social Networks has been Beneficial (Percentages)*

Gender	Strongly agree	I agree	Undecided	In Disagreement	Strongly disagree
-Man	6.6%	10.7%	7.4%	0%	1%
-Woman	14.8%	22.1%	21.3%	6%	5%

Knowledge and Understanding of Information

The acquisition of knowledge and understanding of information are crucial factors in determining the effective use of obtained data. Therefore, we investigated whether COVID-19 information found online helped patients better understand COVID-19 prevention. It was observed that a large majority agreed they had a better understanding of disease prevention after researching it on the Internet. The detailed results were as follows: 43.4% completely agreed, 45.1% agreed, 8.2% were unsure, 0.8% disagreed, and at least 2.5% strongly disagreed. We posed the same question about social media, and the responses were: 23% strongly agreed, 50% agreed, 14.8% were unsure, 3.3% disagreed, and 9% strongly disagreed. When contrasting these data, we found greater trust in websites than in social networks, with 88.5% in the affirmative with website data and 73% on social media. If we analyze the characterization by gender, we find the following about those who searched for information on websites (See Table 8).

Table 8. *Characterization: The Information Found on Websites Helps Patients Better Understand COVID-19 Prevention (Percentages)*

Gender	Strongly agree	I agree	Undecided	In Disagreement	Strongly disagree
Man	13.9%	8.2%	2.5%	0%	1%
Woman	27.0%	34.4%	4.9%	1%	2%

The gender characterization reveals a more significant improvement in the understanding of COVID-19 prevention among women (61.4%) compared to men (22.1%), after searching for health information on websites. If we analyze the characterization by sex, we find the following regarding those who sought information on social networks (See Table 9).

The gender characterization reveals a more significant improvement in the understanding of COVID-19 prevention among women (50.8%) compared to men (18.8%), after searching for health information on social media pages.

Interaction with COVID-19 information on the Internet provides knowledge regarding symptoms of the disease. When asked whether they have better understood the symptoms after acquiring more information through the Internet, the vast majority expressed agreement. The responses were: 42.6% completely agreed, 49.2% agreed, 4.9% were unsure, 0.8% disagreed, and 2.5% strongly disagreed.

Table 9. *Characterization of Whether the Information Found on Social Networks Helps Patients Understand COVID-19 Prevention (Percentages)*

Gender	Strongly agree	I agree	Undecided	In Disagreement	Strongly disagree
Man	4.9%	13.9%	4.9%	0%	2%
Woman	16.4%	34.4%	8.2%	3%	7%

The same question was posed about social networks, yielding these results: 26.2% completely agreed, 45.9% agreed, 17.2% were unsure, 1.6% disagreed, and 9% strongly disagreed. Contrasting these data, there appears to be greater trust in websites than in social networks, with 91.8% affirming agreement with information from web pages compared to 72.1% from social media.

The majority of respondents expressed a better understanding of COVID-19 testing after obtaining information from the internet and social media. The responses were: 34.4% completely agreed, 46.7% agreed, 9.8% were unsure, 3.3% disagreed, and 5.7% strongly disagreed.

When we asked the same question about social media, the responses were as follows: 23.8% strongly agreed, 38.5% agreed, 13.1% were unsure, 7.4% disagreed, and 17.2% strongly disagreed. Contrasting these data, we find a greater understanding of vaccines with information from websites than from social networks, with 78.7% in agreement with data from pages and 51.6% from social media, although the difference is not considerably wide.

Respondents have felt better informed about COVID-19 treatment after finding information online and on social media. The responses were: 35.2% completely agreed, 35.2% agreed, 18% were unsure, 4.9% disagreed, and 6.6% strongly disagreed.

When we asked the same question about social media, the responses were as follows: 18.9% strongly agreed, 32.8% agreed, 27% were unsure, 7.4% disagreed, and 18.9% strongly disagreed. Contrasting these data, we find a greater understanding of vaccines with information from websites than from social networks, with 70.4% in agreement with data from pages and 51.7% from social media, although the difference is not considerably wide.

We also asked whether respondents have felt better informed about the aftermath of COVID-19 after finding information on the Internet and social media. The responses were: 28.7% completely agreed, 35.2% agreed, 19.7% were unsure, 9% disagreed, and 7.4% strongly disagreed.

When we asked the same question about social media, the responses were as follows: 16.4% completely agreed, 32.8% agreed, 24.6% were unsure, 11.5% disagreed, and 14.8% strongly disagreed. Contrasting these data, we find a greater understanding of vaccines with information from websites than from social networks, with 70.4% in agreement with data from pages and 51.7% from social media, although the difference is not considerably wide.

We asked Internet users whether they would return to using websites to find COVID-19 or health information in general, and the results were as follows: 45.1% completely agreed, 39.3% agreed, 9.8% were unsure, 4.1% disagreed, and 4.1% completely disagreed.

We also asked the same question regarding social media, and the results were as follows: 23% completely agreed, 36.9% agreed, 20.5% were undecided, 10.7% disagreed, and 9% completely disagreed. When comparing the results, we observed that more people would return to using websites (84.4%) to search for health information than those who would return to social media (59.9%), although in both cases, the majority of the answers were affirmative. (See Table 10).

Table 10. *I would go back to using the Internet or Social Media to find COVID-19 or Health Information*

Medium	Strongly agree	I agree	Undecided	Disagree	Strongly disagree
Websites	45.1%	39.3%	9.8%	4.1%	4.1%
Social Media	23%	36.9%	20.5%	10.7%	9%

If we analyze the characterization by gender, we find the following about those who searched for information on websites (See Table 11).

Table 11. *Gender Characterization on Whether they Would Return to using Websites to find Health and COVID-19 Data (Percentages)*

Gender	Strongly agree	I agree	Undecided	In Disagreement	Strongly disagree
Man	10.7%	9.8%	3.3%	2%	0%
Woman	32.0%	23.8%	8.2%	2%	2%

Gender characterization tells us that there were more women (55.8%) than men (20.5%) who affirmed that premise regarding returning to using websites to find health and COVID-19 data. If we analyze the characterization by gender, we find the following about those who sought information on social networks (See Table 12).

Table 12. *Gender Characterization on whether they would Return to using Social Media to find Health Data (Percentages)*

Gender	Strongly agree	I agree	Undecided	In Disagreement	Strongly disagree
Man	5.7%	9.8%	6.6%	2%	1%
Woman	15.6%	22.1%	16.4%	7%	7%

The gender characterization tells us that there were more women (37.7%) than men (15.5%) who affirmed that premise regarding returning to using social networks to find health and COVID-19 data.

Finally, we asked the question of what source you were thinking of when you needed health or COVID-19 information. The results are as follows: 42.6% websites, 28.7% their doctor, 9.8% relatives, 5.7% specialized magazines and books, 4.1% insecure, 3.3% friends, 3.3% social networks, 1.6% nurse, 0.8% health application (app) on their cell phone, pharmacist 0%.

If we analyze the characterization by gender, we find the following about the sources used primarily when they needed health or COVID-19 information (See Table 13).

Table 13. *Gender Characterization of the Primary Sources used for Health Search and COVID-19 (Percentages)*

Gender	Web	Doctor	Relative	Specialized Books and Magazines	Insec	Friend	Soc Med	Nurse	App	Pharma
Man	14.8%	4.1%	4.1%	0%	2%	0%	0%	0%	0%	0%
Woman	27.0%	24.6%	4.1%	5%	2%	2%	0%	2%	0%	0%
Total	41.8%	28.7%	8.2%	5%	4%	2%	0%	2%	0%	0%

The table indicates that women tend to search for more health and COVID-19 information both online and offline compared to men. Regarding websites, 27% of women consider them as their primary source of health information, while only 14.8% of men do so. Following websites, doctors are cited by 24.6% of women and 4.1% of men. Relatives are the third most mentioned source, with 4.1% for both men and women. Specialized books and magazines were mentioned only by women (5%). Other sources such as friends, social media, nurses, mobile apps, and pharmacists received less than 5% from both men and women.

Discussion

Our study observed that internet and social media users are seeking information on various topics, conditions, and diseases, with COVID-19 becoming one of the most requested and sought-after subjects.

The doctor-patient relationship is impacted by information from social media and the Internet, generally positively, although not with a significant impact. Doctors have gradually accepted that patients are empowered with information from the Internet and even from social networks. However, it is a process that has not concluded and may be years away from reaching a generalized level of acceptance.

Patients communicate with each other, so we examined the patient-patient relationship and how the internet, especially social media, intervenes and serves as a base of operations for that relationship. Sharing information with peers has definitely had an impact, but not as much as sharing information with doctors.

In terms of knowledge acquisition, perhaps this is where we see the greatest effect. Internet users claim, in several instances, to have been informed, both through websites and social networks, about different aspects of COVID-19, denoting trust in these media to take the information they obtain seriously.

In general, there is a tendency to trust websites more than social networks, which may be due to the source of this information. It is interesting and contradictory that social networks are not mentioned as primary sources of health and COVID-19 information, yet they are consistently utilized and influencing healthcare.

Conclusions

In this analysis of the impact of social media and the Internet on Puerto Ricans' health and COVID-19 decisions, we have found that doctors hold the greatest importance when it comes to making health-related decisions, but the Internet and social media are increasingly influencing people's health choices. Additionally, traditional media continue to play a role, albeit facing significant competition from the aforementioned digital platforms.

The diseases and conditions for which information is sought have been evolving, with COVID-19 occupying a prominent position. In this study, conducted during the pandemic, COVID-19 ranked first in search queries.

The doctor-patient relationship is being affected by health and COVID-19 information available on websites and social media. This impact is evident in the perceived improvement in the relationship, the increase or decrease in questions for healthcare professionals, and the decision whether to visit the doctor after obtaining information from these digital sources.

Regarding the patient-patient relationship, social media plays a significant role in fostering communication and information-sharing among patients. They find value in exchanging health and COVID-19 information through these platforms.

The knowledge acquired through these channels also influences health decisions. Users report a greater understanding of COVID-19 prevention, symptoms, testing, vaccine information, treatment, and the aftermath of the virus after accessing information online and through social networks.

The satisfaction with this information is evident in respondents' willingness to use websites or social networks to find health and COVID-19 information, with the majority expressing a positive inclination. Interestingly, respondents mentioned considering websites as their primary source of information, followed by consulting their doctor. It's worth noting that while websites are readily accessible, consulting a doctor may not always be as convenient.

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Trends of Potential Years of Life Lost in Pavia Province (Italy) in the Period 2015-2021: The Impact of COVID-19

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The World Health Organization has declared the novel coronavirus disease, COVID-19, a pandemic from 2020 to 2023, causing more than 6.8 million deaths worldwide (updated March 2023). In record time, an anti-COVID-19 vaccine was created and large-scale mandatory vaccination was carried out. In Italy the first anti-COVID-19 vaccination started at the end of 2020. The work aimed to evaluate the impact of the COVID-19 on premature mortality in Pavia Province (Italy) with about 500,000 people in 2 different time points, during the pandemic without vaccination and with mandatory vaccination, in relation to the pre-pandemic period using Potential Years of Life Lost (PYLL). PYLL is a tool used to evaluate the effect of a specific disease on mortality for all causes. PYLLs were calculated for the 3 upper age limits (UAL): 70, 80, 90 years. The PYLL indicators showed the highest level of years of life lost in 2020, the period associated with the COVID-19 pandemic without vaccination and only other protective/preventive measures. The PYLLs decrease in 2021 to the pre-COVID-19 level may be associated with the introduction of mandatory vaccination.

Keywords: *PYLL, UAL, COVID-19, pandemic, Northern Italy*

Introduction

On March 11, 2020, the World Health Organization (WHO) declared a pandemic of a new coronavirus disease – COVID-19, which caused a huge number of deaths in many countries of the world, including Italy. The novel coronavirus spread rapidly. Globally, 759,408,703 confirmed cases and 6,866,434 deaths since the start of the pandemic (updated March, 2023) (WHO 2023). Italy has been one of the most severely affected countries in the world. There were 25,623,644 cases and 188,538 deaths due to COVID-19 in Italy (update March, 2023) (Ministry of Health, Italy 2023).

In record time, a vaccine against COVID-19 was created and large-scale mandatory vaccination was carried out, together with generally accepted measures such as lockdown, masks, distance, disinfection. Over 13 billion vaccine doses

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have been administered worldwide as of March, 2023 (WHO 2023). In Italy the first anti-COVID-19 vaccination started at the end of 2020.

Literature Review

The COVID-19 pandemic will certainly go down in human history as one of the most terrible pandemics. Boutsioli et al. (2022) noted that the scientific community quickly responded to the new infectious disease with numerous studies, publishing articles in the fields of health, sociology, economics, education and so on. In a short time, the main clinical signs of the disease were identified and diagnostic tests were created.

Papanikos (2021) evaluated the impact of lockdowns and vaccinations, the outcomes of atmospheric temperature on the number of deaths due to COVID-19 in Greece. The author concluded that the lockdown and vaccinations had the positive effect of decreasing the number of deaths and that "high weather temperatures reduce the infections and therefore the deaths from COVID-19".

One of tools useful to assess the overall impact of a specific disease on mortality is Potential Years of Life Lost (PYLL). The PYLL estimates the average time a person would have lived if he/she had not died prematurely. If life expectancy depends on mortality, PYLL depends on mortality and the age structure of the population (Islam et al. 2021).

Various methods are used to calculate PYLL: some authors used the standard life expectancy table (Yousefi et al. 2023, Quast et al. 2022); others (Vieira et al. 2021) used the formula proposed by Romeder and McWhinnie (1977) and Mitra et al. (2020). While Serpa Neto et al. (2021) calculated as "difference between the life expectancy for each sex in the year of inclusion and the actual age of the individual when they died".

According to several published works (Vieira et al. 2021, Serpa Neto et al. 2021, Pifarré I Arolas et al. 2021), the increase in the number of deaths and as a consequence of PYLLs during the COVID-19 pandemic mainly occurred among the elderly population. Most studies showed that PYLL was higher in men than women during the COVID-19 pandemic. Specifically, Yousefi et al. (2023) found that men were responsible for 55% of the total number of PYLL for people living in the Khorasan-Rasavi Iranian province. Similarly, Pifarré I Arolas and co-authors (2021) in a multicentre studies involving 81 countries showed that in men had PYLL due to COVID-19 higher than in women. Chan et al. (2021) found that PYLL in the United States was mainly due to men rather than women (61% vs 39%). In Germany, a similarly study by Rommel et al. (2021) estimated again that men contributed to PYLL more than women (60.1% vs 39.9%). The French study by Haneef et al. (2023) showed that men are responsible for 57% of PYLL. Finally, Vieira et al. (2021) found that in the European countries investigated (France, Germany, Italy, Netherlands, Portugal, Spain, Sweden, United Kingdom) men had around 60% of PYLL due to COVID-19.

The evidence of PYLL caused by COVID-19 in Italy is sparse and lacking for Pavia Province.

Objective

The present work aims to evaluate the impact of the COVID-19 on premature mortality in Pavia Province placed in the Northern part of Italy, in the Lombardy region in two different time points, during the pandemic without vaccination and with mandatory vaccination, in relation to the pre-pandemic period using PYLL.

Materials and Methods

Study Setting, Population, Time Period

The study is carried out on the residents in Pavia Province in Lombardy Region, placed in the Po Valley (Northern part of Italy). The Lombardy is the most populated among Italian region. During the early stages of the COVID-19 pandemic it was the Region most affected by both COVID-19 deaths and Sars-Cov-2 positivity.

The study population was composed in average by 500,000 people by year. The study period was divided in three calendar period: 2015-2019 corresponding to pre-pandemic, 2020 to pandemic without vaccination and 2021 to pandemic with mandatory vaccination.

Endpoints and Variables

The endpoint was the combine of death with the age to death. The cases of death for all causes were of interest. The information on gender was also collected.

Sources of Data

Different data sources were used. Death cases and age to death were obtained from the Mortality Registry of the Local Health Agency of Pavia (in Italian Agenzia di Tutela della Salute of Pavia). Socio-demographic data on the Pavia Province population and on Italian population were extracted from the open website of the National Institute of Statistics (ISTAT) and DemoISTAT (ISTAT)[1].

Statistical Analysis

The study population was divided in ten age group ranging 10 years. PYLL was calculated for the 3 upper age limits (UAL): 70, 80, 90 years (yrs). The choice of upper age limits of 70 and 80 years was based on the works of Romeder and McWhinnie (1977) and Mitra et al. (2020). According this, the PYLL was calculated using the formula proposed by Romeder and McWhinnie (1977):

$$PYLL = \sum_{i=1}^{UAL-1} a_i \times d_i = \sum_{i=1}^{UAL-1} (UAL - i - 0.5) \times d_i$$

[1]Available at: http://dati.istat.it/; https://demo.istat.it/.

where *UAL* is upper age limit 70, 80, 90; a_i is the remaining years to live until the upper age limit; d_i is the number of observed deaths in each age group; *i* is the mid-point of the class interval of each age group; 0.5 is a constant when the mid-point is not a whole number.

The new upper age limit of 90 years was based on life expectancy in Italy, which was over 80 years (Worldometer 2023). PYLLs were calculated for age group, by sex and per person death. The total PYLL is the sum of all age- specific PYLLs.

PYLL rate and Standardized PYLL rate per 100,000 population were also estimated using the following formulas:

$$PYLL\ rate = PYLL/(population\ under\ UAL\ years) \times 100{,}000$$

$$Standardized\ PYLL\ rate = \sum_{i=1}^{UAL-1} (PYLL/P_i) \times (P_{ir}/N_r) \times 100{,}000$$

where *UAL* is equal to 70 or 80 or 90 yrs, P_i is the number of people in the age group *i* in the actual population, P_{ir} is the number of people in the age group ***i*** in the reference population (Italian), and N_r is the number of people between ages *1* and (*UAL – 1*) in the reference population (Ugarte et al. 2022).

Analyses were made using STATA 17.0 Statistical Software and Excel.

Results

The total amount of deaths in Pavia Province during the study period was 51,339, greater in the 2020 pandemic year without vaccination (9,246 deaths) with respect to the others years (6,947 deaths in average during pre-pandemic 2015-2019, 7,357 deaths in pandemic year with vaccination). It was found that men and women showed a different structure of death by age-class (see Table 1). In men deaths occurred prevalently over 60 years (about 90%), on the contrary in women over 70 years.

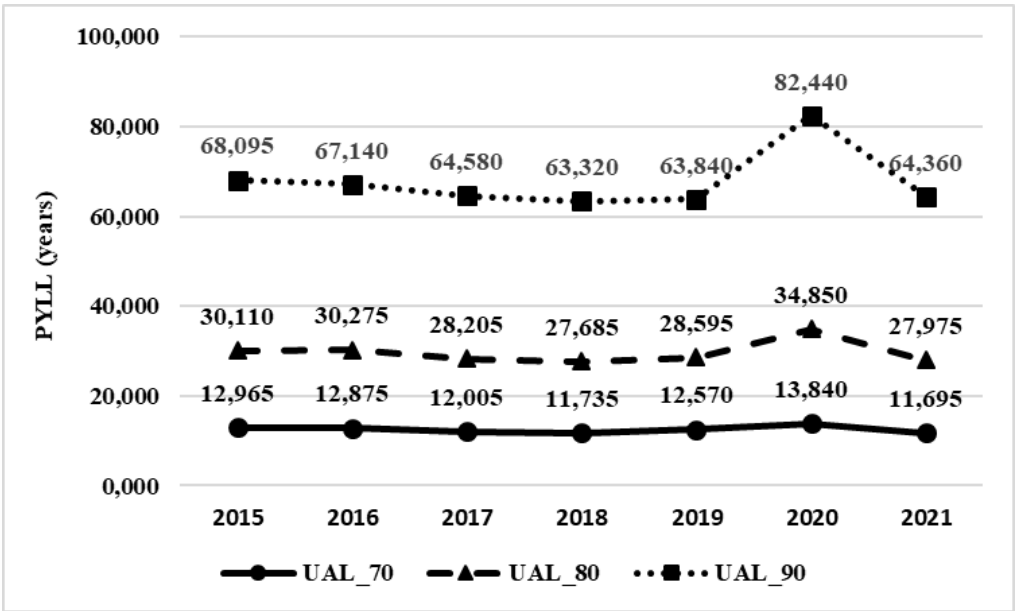
The PYLLs showed a stable trend until 2019 then increased in 2020 in all the UALs (see Figure 1). The pattern was similar from the period before pandemic to 2021 by all UALs. In average the PYLL for the 5 years before pandemic (2015-2019) was 12,430, 28,974 and 65,395 years a respectively for 70, 80 and 90 UAL. After an increase of 11.3%, 20.3% and 26.1%, respectively for 70, 80 and 90 UAL, occurred in 2020, but the PYLLs dropped to the same pre-pandemic level in 2021.

Table 1. *Death Structure (%) by Sex and Age-classes for Each Calendar Year in the Study Period*

	Males						
Age classes	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
≤9	0.22	0.20	0.23	0.27	0.30	0.15	0.25
10-19	0.09	0.07	0.13	0.20	0.13	0.17	0.06
20-29	0.60	0.41	0.42	0.33	0.49	0.35	0.38
30-39	0.60	0.47	0.58	0.50	0.85	0.25	0.38
40-49	1.93	2.81	2.00	1.96	1.64	1.51	1.89
50-59	5.97	6.15	5.69	5.72	5.75	5.16	6.05
60-69	**11.13**	**13.29**	**11.44**	**11.67**	**10.87**	**11.78**	**10.96**
70-79	**26.04**	**26.61**	**24.23**	**24.71**	**24.11**	**26.62**	**24.51**
80-89	**38.50**	**37.83**	**40.06**	**40.24**	**38.36**	**39.64**	**38.97**
≥90	**14.92**	**12.17**	**15.22**	**14.40**	**17.50**	**14.37**	**16.54**
	Females						
Age classes	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
≤9	0.22	0.06	0.05	0.09	0.17	0.08	0.11
10-19	0.03	0.06	0.03	0.09	0.08	0.04	0.08
20-29	0.14	0.14	0.08	0.11	0.06	0.10	0.11
30-39	0.35	0.28	0.30	0.17	0.22	0.23	0.22
40-49	0.95	1.05	0.85	1.08	1.05	0.85	0.71
50-59	2.91	3.44	3.25	2.68	3.14	2.48	2.51
60-69	5.27	5.81	4.86	5.65	5.87	5.21	5.84
70-79	**15.73**	**15.57**	**14.52**	**14.64**	**13.31**	**14.41**	**13.87**
80-89	**42.02**	**40.98**	**41.29**	**41.97**	**40.19**	**40.43**	**40.91**
≥90	**32.40**	**32.61**	**34.77**	**33.52**	**35.92**	**36.16**	**35.64**

Source: Mortality Registry of the Local Health Agency of Pavia 2015-2021. Author's calculation.

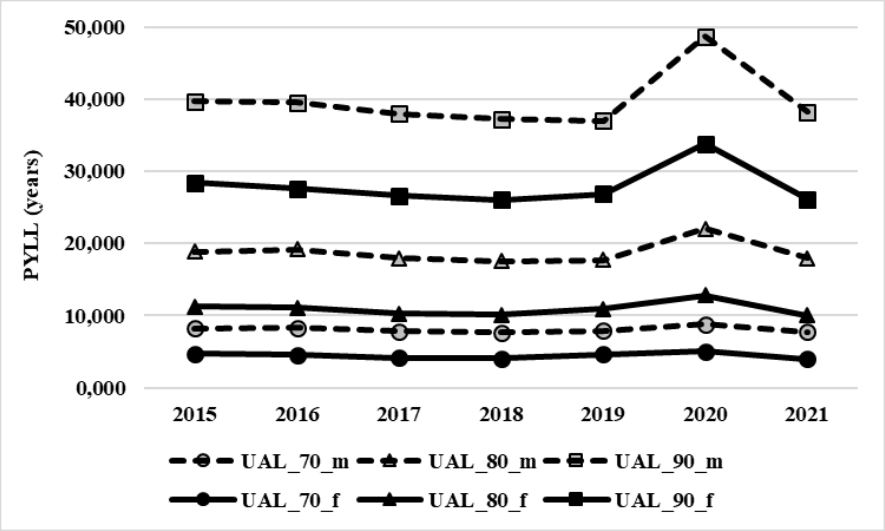
Figure 1. *Trend of PYLLs in the Province of Pavia for Three Upper Age Limits from 2015 to 2021*



Source: Mortality Registry of the Local Health Agency of Pavia. Author's calculation.

The PYLL was higher in males than females in all three UALs (see Figure 2). In UALs 80 and 90 the PYLL was highest in 2020 both for men and women: the excess with respect 2019 in men was 31.7% while in women of 25.7% in UALs 90 yrs, 24.5% and 17.6% respectively in UALs 80 yrs. The increase was less relevant for UAL 70 yrs: 11% in males and 8.4% in females.

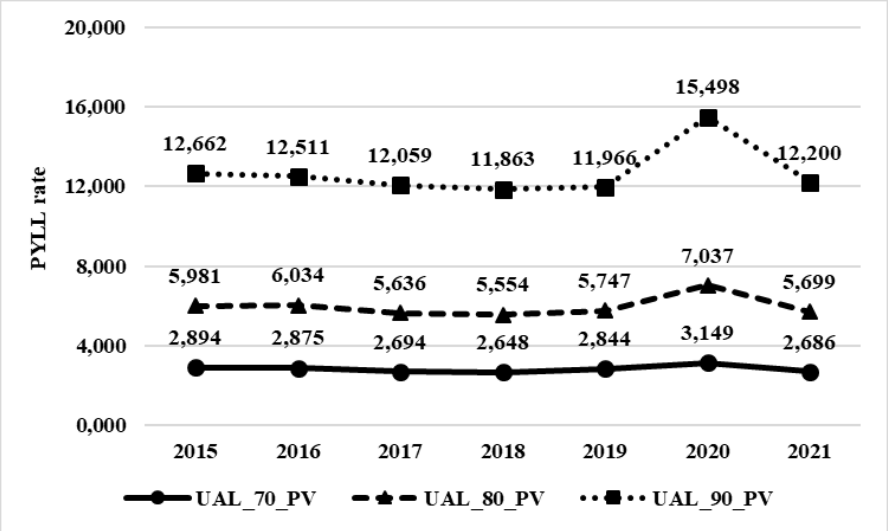
Figure 2. *Trend of PYLLs in the Province of Pavia for Three Upper Age Limits from 2015 to 2021, Separately by Sex (See the Data in the Appendix Table A1)*



Source: Mortality Registry of the Local Health Agency of Pavia. Author's calculation.

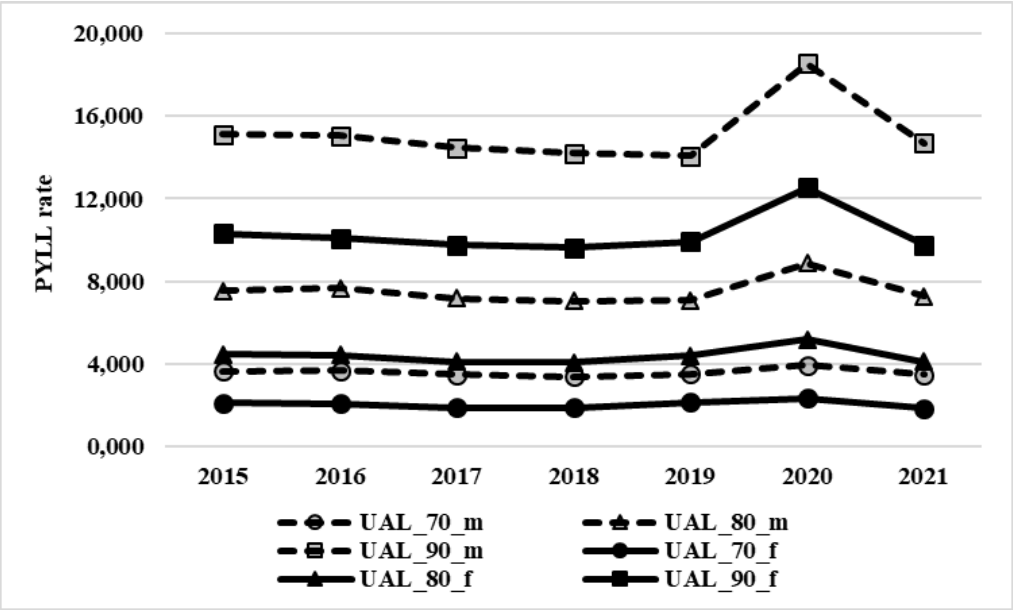
Similarly, the PYLL rate and the Standardized PYLL rate showed for all three UALs a stable trend until 2019, an increase in 2020 with a maximum, and a decrease in 2021 to the same pre-pandemic level for the whole population and separately by sex (see Figures 3-6).

Figure 3. *Trend of PYLL Rate x 100,000 Population for Province of Pavia for Three UALs*



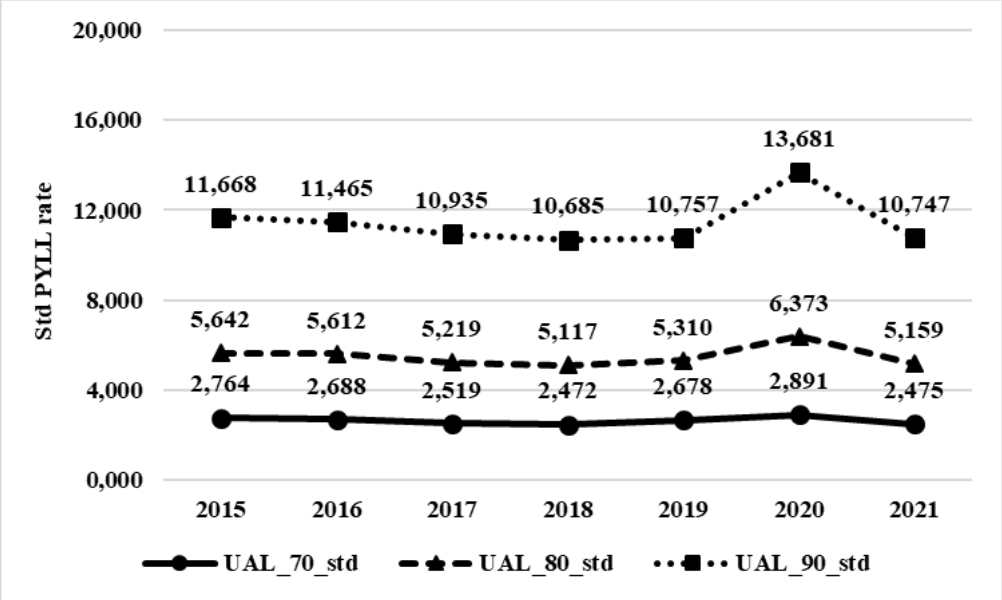
Source: Mortality Registry of the Local Health Agency of Pavia. Author's calculation.

Figure 4. *Trend of PYLL rate x 100,000 Population for Province of Pavia for three UALs, Separately by Sex (See the Data in the Appendix Table A2)*



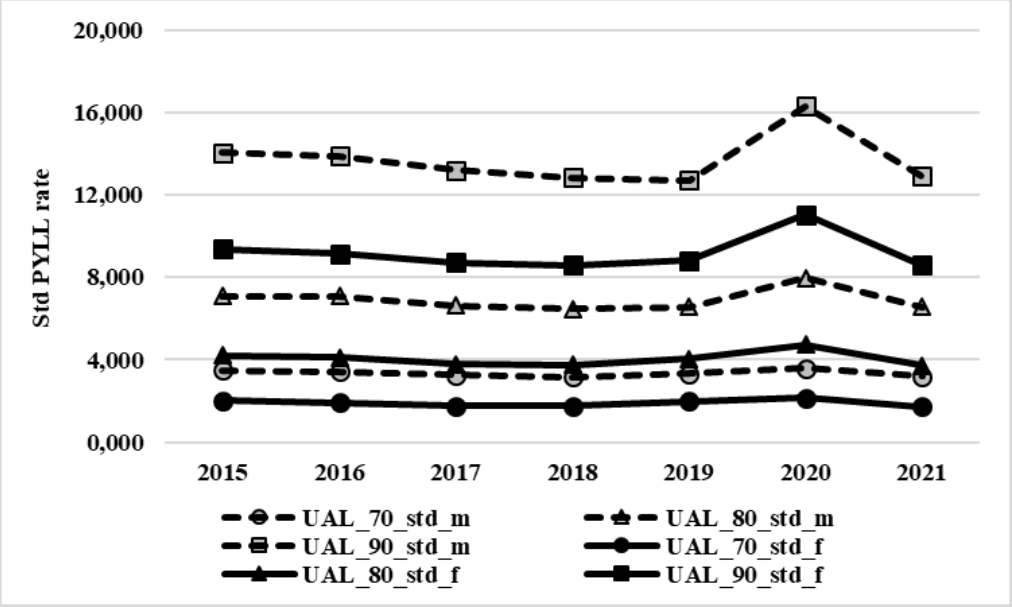
Source: Mortality Registry of the Local Health Agency of Pavia. Author's calculation.

Figure 5. *Trend of Standardized PYLL Rate x 100,000 Population for Province of Pavia for Three UALs*



Source: Mortality Registry of the Local Health Agency of Pavia. ISTAT. Author's calculation.

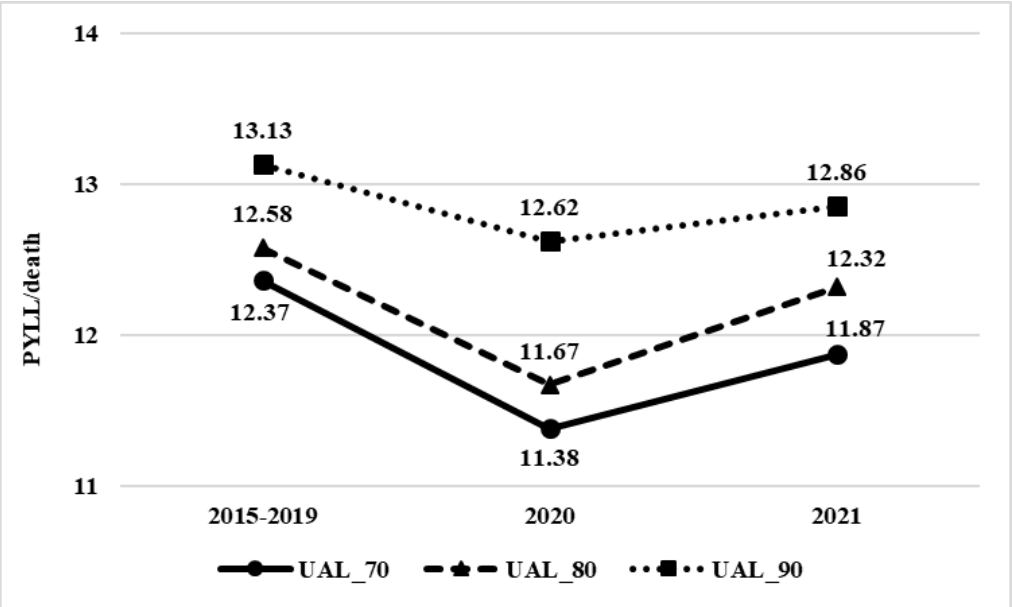
Figure 6. *Trend of Standardized PYLL Rate x 100,000 Population for Province of Pavia for Three UALs, Separately by Sex (See the Data in the Appendix Table A3)*



Source: Mortality Registry of the Local Health Agency of Pavia. ISTAT. Author's calculation.

As expected the average PYLL per death was greater for UAL 90 than for UAL 70 and 80 in all the three studied periods (see Figure 7). The average PYLL/ death presented a similar pattern across UALs with a marked reduction during pandemic period with respect pre-pandemic in UAL 80 (-7.2%) and UAL 70 (-8%).

Figure 7. *Trend of Average PYLL/Death by Three Time Periods*



Source: Mortality Registry of the Local Health Agency of Pavia. Author's calculation.

Discussion

The main findings from present work are:

- the highest level of years of life lost in 2020, the period associated with the COVID-19 pandemic without vaccination and only other protective/ preventive measures
- years of life lost decrease to the pre-COVID-19 level estimated in 2021, the pandemic period with mandatory vaccination
- the men contributed more to PYLLs than women
- a greater reduction of PYLL/death in 2020 in over 70 and over 80 years (UALs 70 and 80 yrs, respectively) than in over 90 years (UAL 90 yrs).

Our results are comparable with other studies, despite different methods for calculating PYLL (Vieira et al. 2021, Ferenci 2021, Rangachev et al. 2022). Higher PYLL values may be associated with more numbers of death or deaths at a younger age.

The reduction of deaths recorded in 2021 to the pre-pandemic level may be associated with the introduction of mandatory vaccination. Instead, the less marked reduction of PYLL/death in UAL 90 yrs may be due to the fact that the people over 90 years have been already "died" for other causes since they are generally more frail. On the contrary people over 70 yrs and over 80 yrs having a drop in PYLL/death doubled with respect to over 90 yrs may be characterised by comorbidities and so remaining life expectancy is shorter than the average person's remaining life expectancy. This different comorbidity distribution introduced a selection bias which consequently biased the estimates. Some authors' supposed that total PYLL in COVID-19 pandemic may be an overestimate by different mortality risk due to comorbidities (Palmieri et al. 2020, Robilotti et al. 2020, Chen et al. 2020).

The present work shows the great importance of vaccination not only to prevent hospitalization of infected people, but also to reduce deaths in agreement with published evidences (Machado et al. 2022, Hulíková Tesárková and Dzúrová 2022, Rachaniotis et al. 2022): the maximum number of deaths and years of life lost occurs during the period without mandatory vaccination.

Our study has some limitations first of all, we cannot use on COVID-19 deaths and so we may not estimate the direct contribution of COVID-19 to PYLL. Our findings may underestimate PYLLs.

Conclusions

In our opinion, the approach used in the present work may serve as a useful tool for studying the effects of vaccination on PYLL. Similar to life expectancy, the PYLL is a good measure for an overall health of an area. Unlike many other health statistics, the PYLL places additional emphasis on death of younger peoples, helping the efficacy and effectiveness of local sanitary system.

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Appendix

Table A1. *PYLLs in the Province of Pavia for Three Upper Age Limits from 2015 to 2021*

	2015	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
UAL_70_m	8,260	8,300	7,850	7,635	7,920	8,800	7,710
UAL_80_m	18,880	19,155	17,940	17,560	17,690	22,030	17,940
UAL_90_m	39,710	39,540	37,980	37,250	36,970	48,675	38,245
UAL_70_f	4,705	4,575	4,155	4,100	4,650	5,040	3,985
UAL_80_f	11,230	11,120	10,265	10,125	10,905	12,820	10,035
UAL_90_f	28,385	27,600	26,600	26,070	26,870	33,765	26,115

Notes: **UAL** is upper age limits, **70, 80, 90** are the age for UALs, **m** is male, **f** is female.

Table A2. *PYLL Rate x 100,000 Population for Province of Pavia for Three UALs, Separately by Sex*

	2015	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
UAL_70_m	3,656	3,671	3,482	3,399	3,531	3,946	3,490
UAL_80_m	7,528	7,650	7,169	7,030	7,082	8,862	7,281
UAL_90_m	15,117	15,058	14,458	14,190	14,059	18,551	14,694
UAL_70_f	2,119	2,063	1,886	1,875	2,137	2,328	1,858
UAL_80_f	4,447	4,423	4,103	4,071	4,401	5,198	4,104
UAL_90_f	10,317	10,071	9,750	9,611	9,932	12,525	9,771

Notes: **UAL** is upper age limits, **70, 80, 90** are the age for UALs, **m** is male, **f** is female.

Table A3. *Standardized PYLL Rate x 100,000 Population for Province of Pavia for Three UALs, Separately by Sex*

	2015	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
UAL_70_std_m	3,480	3,421	3,265	3,173	3,344	3,590	3,196
UAL_80_std_m	7,083	7,094	6,639	6,465	6,556	7,959	6,552
UAL_90_std_m	14,048	13,871	13,193	12,821	12,686	16,303	12,894
UAL_70_std_f	2,029	1,933	1,749	1,746	1,984	2,161	1,721
UAL_80_std_f	4,197	4,121	3,784	3,749	4,038	4,748	3,730
UAL_90_std_f	9,384	9,130	8,726	8,572	8,824	11,031	8,571

Notes: **UAL** is upper age limits, **70, 80, 90** are the age for UALs, **std** is standardadized, **m** is male, **f** is female.

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The Unprecedented Omicron Surge in Hong Kong: A More Natural or More Man-Induced Tragedy?

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COVID-19 infection control in Hong Kong was effective through strict anti-pandemic measures in the first four waves beginning in 2020, although it hurt not only physiological and psychological health but also social and economic activities. However, there was an uncontrollable boom in local Omicron cases and deaths from late January 2022, particularly among the senior population. Epidemiologists bemoaned the low vaccination rate among older adults which attributed to the rapid contagion. This analysis looks into a nexus of causes, and discusses the roles of manpower, medical resources, management, healthcare policies, and the balance between anti-pandemic tactics and individual health. Fundamentally, trust in the government is indispensable to success in combating public health disasters. Medical veterans urge a comprehensive inquiry in order to improve the healthcare system and hence cope with future infectious diseases, which authorities should respond to positively and promptly.

Keywords: *epidemiology, infectious disease, novel coronavirus, pandemic, public health, SARS-CoV-2*

Introduction

An infectious disease briskly spread from Wuhan, China to other countries around the world, and has become a pandemic caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) since March 2020. Its on-going outbreak has brought over 754 million cases and 6.8 million deaths globally as of February 2023. This public health crisis has been greatly impacting physical, mental, social and economic dimensions from individual and community perspectives, which pressures governments in the post-pandemic stage to launch comprehensive reviews in order to ameliorate their healthcare systems.

The first confirmed case of novel coronavirus in Hong Kong was detected on January 23, 2020, going on to total 13277 cases by January 1, 2022. However, the number of cases suddenly climbed to 1157415 as of March 31, 2022 (Worldometer 2022). Daily infections were less than 200 cases before February 4, 2022, but then peaked at 76991 cases on March 23, 2022 (56827 and 20164 cases diagnosed by nucleic acid tests and rapid antigen tests respectively) (Du et al. 2022). Worse, a sharp rise in cumulative deaths hit the city, rising from 213 on February 7, 2022 to 9451 on April 29 (Worldometer 2022), because of which Hong Kong gained one of the highest death rates among developed territories, with the majority of deaths occurring among the older population (Walker 2022). Such a disaster was induced by a low vaccination rate (Lew and Wallbank 2022), as many medical professionals

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reiterated (Cheung et al. 2022, Looi 2022) that the elderly remained a higher risk group connected with slow viral decline (Li et al. 2022). Experts explained that a lower vaccination rate among seniors exerted a lower level of protective immunity and therefore a higher case-fatality rate (Chen et al. 2022). Although a report was presented by the Chief Executive (the head of Hong Kong government) to calm fears related to this fatal spread (Lam 2022), it lacked reviews for what caused the tremendous pandemic-related deaths over the seven week period, especially the onslaught against older adults.

Chaotic Wave

Hong Kong underwent four waves of COVID-19 from 2020 to 2021, in which the containment strategy led to comparatively low infection and death rates; however, the containment measures failed in the fifth wave (Strumpf, 2022). Before this wave, there were almost no local cases for six months (K. Yuen et al., 2022). The first local case of the fifth wave was reported on December 31, 2021 (Centre for Health Protection, Department of Health, 2022), associated with two flight attendants who breached anti-coronavirus rules (Tsoi 2022). A series of incidents fuelled an outbreak in early January 2022, such as an Omicron restaurant cluster (Low et al. 2022), a birthday party involving senior officials and lawmakers (Lam 2022), and a batch of pet-store-related Delta variant cases (Mallapaty 2022). A cleaning worker who lived in a public housing estate was infected in a quarantine hotel and transmitted the virus to her family. Very soon, super-spreaders were tested for in that estate, resulting in the first lockdown building (Lee 2022b). This large-scale outburst began in mid-February (Thomas 2022).

Clinical research has shown that the Alpha variant produces more severe cases and deaths (Florensa et al. 2022) and the Delta variant generates higher transmission and mortality, together with increased likelihood of hospitalisation (Yomayusa et al. 2022). Despite its heightened transmission rate, Omicron inclines towards upper respiratory tract symptoms, a lower comorbidity burden and reduced severity (Leiner et al. 2022, Petersen et al. 2022). Asymptomatic or mild patients show symptoms similar to the flu or common cold (Cheung et al. 2022); thus, a massive climb in fatality in this wave, which was dominated by the Omicron variant, is unexpected.

The dynamic zero-COVID policy was implemented in China from August 2021 to curb the highly transmissible Delta variant (Bai et al. 2022) and lessen the negative influences on socio-economic stability (Liu et al. 2022). Hong Kong also enforced it (Burki 2022), even though the Chief Executive was incapable of defining it (Wang and Ramzy 2022). Long-lasting, stringent measures did not only invoke anti-pandemic burnout, but also inevitably isolated Hong Kong from the outside world and created an economic downturn (Stevenson 2022), including extensive contact tracing and screening, social distancing, vaccine pass implementation, masking, working from home, school suspensions, quarantines, travel restrictions and flight bans (Lau et al. 2022). If these draconian means had

been able to relieve this coronavirus tsunami, the Omicron catastrophe could have been prevented.

An Uncontrollable Surge: Avoidable or Unavoidable?

LeaveHomeSafe, a digital tracing application, was launched in November 2020 and was mandatory for entering government offices, which was extended later to include restaurants and many other businesses (Leung 2023a). It was devised to warn those who visited premises with coronavirus cases, but people used it unwillingly because of worries about privacy and security (Chan 2021). Indeed, this tool failed to deal speedily with the ceaseless growth of Omicron, and stopped sending notifications from late February 2022 (Yeo 2022). However, the government insisted in forcing its use until mid-December 2022 (Lee 2022g), though this regulation was often breached even by bureaucrats (Radio Television Hong Kong 2022a).

Medical staff, visitors to hospitals, restaurant employees, care home staff and visitors, school staff and students, inbound travellers, and close contacts of infected persons undertook mandated polymerase chain reaction (PCR) or nucleic acid tests (Pang and Master 2022). In addition, residents who lived in buildings with detected coronavirus in sewage, along with visitors to those locations, were required to fulfil testing orders. During the Omicron outburst, long queues for compulsory testing with elderly individuals and children lining up for hours in tight spaces appeared outside makeshift testing stations in different districts (Ramzy 2022), increasing the risk of transmission chains (Heung and Tsang 2022). Later, rapid antigen tests (RAT) were accepted and kits were distributed for voluntary self-testing (Lau et al. 2022), offering an online registration system for self-reporting (Hong Kong Government 2022b). Mandatory testing challenged laboratory capacities by producing a huge backlog volume, but the requirement persisted even though it was found helpless in combating this wave (The Asean Post 2022).

An explosion in confirmed Omicron cases hampered the overloaded emergency service from properly triaging people who needed medical care, causing hospitals to be jammed up with patients and causing a decline in healthcare service. In fact, most had only moderate symptoms such as headaches and fevers. Medical leaders exhorted mild and asymptomatic cases to stay home, drink more water and take medications such as painkillers or cough syrup (Cheung 2022b, Lee 2022a). Inadequate healthcare arrangements diminished public health service capacities.

Compulsory hospital admissions and isolation for thousands of infected residents and their close contacts, along with certain persons arriving in Hong Kong, quickly filled up hospital beds and isolation centres. Some epidemiologists suggested adjusting discharge criteria and allowing mild and asymptomatic individuals to return home to free up hospital facilities (Frost 2022, Master 2022a). However, these adjustments made discharge arrangements more complicated and therefore reduced outcomes (Canete 2022).

The citywide COVID-19 Vaccination Programme was launched on February 26, 2021 free of charge for those aged 18 and above to safeguard the public health, and then starting on June 14 those aged 12-17 were included. The age inclusion was lowered further to age 11-5 on January 21, 2022, and again on August 4 for infants as young as six months. Regrettably, vaccine resistance and hesitancy remained, particularly among older adults (Lee 2022e). The government made much effort to promote vaccination, but without satisfactory results, including requiring the debated Vaccine Pass in 24 specified premises starting February 24, 2022, and even in public medical centres from June 13, 2022 (Cheng 2022b). Defiance was connected to individual (lack of trust and confidence in the vaccine, perceptions of poor long-term effectiveness, fragile social networks, and peer pressure), micro-social (stigma against "dirty" healthcare workers), intermediate-social (distrust in the government), and macro-social (cultural influences, perceptions of vaccination as viral injection, the role of medical experts, and civic responsibility) factors (Siu et al. 2022), largely related to vaccine safety and side effects (Wang et al. 2021), especially for those with chronic illnesses (Zhang et al. 2022). Instead of solving problems, the government gave baffling reactions. For example, it swiftly stipulated an ordinance in mid-2022 in which unvaccinated workers may be terminated without compensation (Ho 2022b) in order to boost inoculation, implying agreements with social injustice and inequality at the workplace as recognised by the government. Failure of the Programme likely initiated with a misstep in which Sinovac, an inactivated virus-based vaccine, was approved for use before the third phase clinical data had been released (Kwan 2022). The underlying cause is distrust of the government (Cheung et al. 2022).

Low morale among health practitioners (Mahtani and Yu 2022a) further exacerbated this wave. The crushing widespread increase in cases catalysed an unbearable burden on a healthcare system already at the edge of collapse (Hollingsworth et al. 2022) from an immense patient load and COVID-positive healthcare personnel (Sataline 2022) in an underfunded healthcare system (H. Chan and Xinqi 2022). Additionally, under the Emergency Regulations Ordinance, mainland healthcare workers were allowed to work in Hong Kong provisionally in February and March, 2022 (Hong Kong Government 2022a, 2022c), avoiding licensing regulations. Collaboration between local workers and their mainland counterparts did not run well in practice: for example, resource allocation, ward patrol and shift schedules (Ma 2022).

Calamitous Deaths

Under the Prevention and Control of Disease Ordinance, COVID patients were sent to hospitals, and their close contacts to isolation facilities (Tsang et al. 2022), as explicated earlier. Mandatory hospital admission was not a scientific consideration, and instead increased health risks during the Omicron wave (Master 2022b). An influx of positive carriers, regardless of asymptomatic and mild cases, flooded the Accident and Emergency Department of public hospitals just to satisfy the purpose of dynamic zero-infection policy (Cheung 2022a); hence, hospitals were filled to overcapacity, which made things worse, as a 140% occupancy rate

(Ho 2022a) resulted in a low turnover rate of hospital beds (Master and Siu 2022, The Standard 2022). Patients on gurneys or wheelchairs were lined up outside hospitals, and thousands awaited isolation facilities (Cheng 2022, Wai 2022), without sufficient numbers of frontline healthcare workers. Unfortunately, the cold weather worsened this predicament (Sedgman 2022). All these unfavourable factors spiked the mortality rate to the highest death rate in the developed world (Hutton 2022a), and overwhelmed already scarce mortuary and funeral facilities (Mahtani and Yu 2022b).

Case mishandling has been complained of repeatedly throughout the pandemic. The crumbling healthcare system during the Omicron storm increased the number of COVID cases where patients were not served in time or even died before being delivered to hospitals (Lee 2022c), together with confined people dying in quarantine venues (Yiu 2022). Such a tragedy unveils not only misjudgements made in this deteriorating situation and how the problem was underestimated by relevant officials, but also the weaknesses of primary medical care and neighbourhood support (Mingpao 2023).

Reflection and Recommendations

Complicated, harsh, illogical and inconsistent restrictions (Davidson et al. 2022) are ineffective in dealing with this contagion. The accumulative infected cases and deaths reached 2880328 (1219813 PCR confirmed and 1660515 RAT confirmed) and 13409 respectively, as of February 9, 2023 (School of Public Health, LKS Faculty of Medicine 2023). More than 99.9% of infections and fatalities occurred in this Omicron outbreak, after US$76.9 billion (HK$600 billion) had already been spent for three years of pandemic control and relief programmes among 7.4 million people (Ho 2023). Medical specialists have proposed an independent inquiry to look into various aspects of anti-COVID restrictions (Cheng et al. 2023, Radio Television Hong Kong 2023, The Standard 2023), but the Hong Kong government has clearly refused (Leung 2023b).

The Principal Officials Accountability System has been in place since 2002 in order to ensure a clear understanding of officials' respective responsibilities, implement policies effectively, cope with challenges proactively, respond to community needs efficiently, and enhance public services (Hong Kong Government 2002). A SARS Expert Committee investigated the severe acute respiratory syndrome (SARS) outbreak in 2003, which resulted in 1755 cases and 299 deaths (Lee et al. 2006), and issued a report (SARS Expert Committee 2003) to review the causes of that public health disaster and suggest improvements in deploying healthcare resources. This checks and balances mechanism resulted in officials' being personally responsible for the failure of their policies, and therefore gained trust and support from the public. The COVID-19 pandemic has yielded many times more medical expenditures and losses of both life and economy than SARS, nonetheless the government refuses to acquiesce to the Accountability System, by its rejection of in-depth, thorough, open, transparent, reliable, and legally binding examinations of this three-year public health fight.

Prevention and control tactics should be scientific and evidence-based decisions. Notwithstanding, the government is frequently to be blamed for ignoring public health expertise while making overly politics-driven efforts to show fidelity to the mainland authority, whereas opposition voices are silenced (McLaughlin 2022). In early 2022, medical professionals warned that containment measures were impractical for controlling the Omicron spread and that a strategy change was necessary in order to resume normal life (Lung et al. 2022). Social distancing was no longer effective against Omicron (Hung et al. 2022): for instance, restrictions on gathering limits in public and private places. Thereafter, microbiologists realised that the pandemic has become endemic (Radio Television Hong Kong 2022b), and urged preparation for a living with COVID approach (Lee 2022d). The government still integrated closely with the mainland anti-pandemic policy (Hong Kong Government 2022e). Unexpectedly, the zero-COVID strategy began to be lifted in December 2022 after the stance was abandoned by Beijing (Magramo 2022), with full reopening of the Hong Kong-China border on February 6, 2023 (Zhao 2023). Such an abrupt relaxation is paradoxical whilst local cases continued to soar (Zhao and Creery 2022), which was an irrational contradiction of the evidence.

Human resource is a significant asset in healthcare service. Lamentably, healthcare practitioners were disappointed by the authorities which greatly harmed their morale. About 8000 healthcare workers from public hospitals joined a strike in early February 2020, pressuring the government to close the Hong Kong-China border completely to inhibit the spread of COVID-19 in order to sustain the healthcare system and community safety (Cheng 2021b). Their demand was not in error, but they were eventually penalised (Leung 2020). Coupled with political concerns (Cheng 2020, Dimsumdaily Hong Kong 2021), these severely bungled outbreaks accelerated the growing exodus of medical professionals (Kihara 2021, The Standard 2021), and nearly paralysed healthcare services during the Omicron invasion. Supplementary retention plans (Hong Kong Government 2022d), such as retirement extensions, a new rank hierarchy and a low-interest home loan scheme, did not alleviate the turnover effectively.

The highly dense city population encourages the rapid transmission of infectious diseases (Das 2022), and the open-plan layout design of residential care homes congested with numerous single-person beds speeds the spread of infections (Chow 2021). Deaths among those over 65 years old made up 91.67% of the third wave, which involved many elderly care homes in mid 2020 (Cheng 2021c, Pao 2020). Infection rates increased among care workers, reaching 9.5% in the fifth wave (Das 2022). Poor working conditions, long working hours and under-paid salaries make it difficult to recruit trained staff (China Labour Bulletin, 2022). Workforce shortages and crowded work environments erode service quality and the wellness of residents. The government should take more responsibilities for elderly welfare services.

Restrictive controls implemented to curb COVID spread negatively impact not only psychological and emotional health (Cheung et al. 2021), but also family relationships and adaptation to social challenges (Hung et al. 2022), especially for disadvantaged groups (Liao et al. 2021, Zhao et al. 2020), including sexagenarian

individuals and low-income families. This consequence very apparent in the senior population, in which more than one-third exhibit signs of depression and anxiety (Hutton 2022b). Particularly, those in care homes suffer from loneliness (Ho et al. 2022) due to the no visit policy and related forbidding measures. In spite of modern communication technology, online relationships never replace bodily connections and interaction between residents and their family members (Hung 2022). The government ignored the imperative of mental and emotional care, and lost the balance between anti-pandemic methods and quality of life.

Tight restrictions have fiercely battered the economy and ushered in the demise of various segments such as the tourist industry (Tsui et al. 2021) and catering sector (Lee 2022f). Subsequently, deficits fell to US$29.9 billion (HK$233 billion) and US$17.9 billion (HK$140 billion) in the 2020-2021 and 2022-2023 fiscal years correspondingly (Lee 2023, The Treasury Branch, Financial Services and the Treasury Bureau 2023), with a drop of in the gross domestic product of 4.5% to 9% (Grundy 2022, Yuen 2022). Recession was inevitable (Riordan & Chan, 2022). Although the post-pandemic budget proposes a US$97 billion (HK$761 billion) expenditure to boost economic activities, recovery seems uncertain (CNBC 2023).

Incompetent leadership, "failed" (Marques 2020) governance, inflexible tactics, policy loopholes (Cheung 2020) and loose preparation deteriorate the leading role of the government. With lessons learned from SARS 2003, the Hong Kong people are vigilant against infectious diseases, reinforcing community health awareness (Cheng 2021a). They responded to the outbreak proactively through personal protection behaviours, including personal isolation, physical distancing, masking and personal hygiene. For example, the first confirmed COVID case evoked citizen to panic-purchase masks even while the government rejected masking (Chung 2020). Moreover, the slow reaction on the part of authorities was ineffective for different stakeholders; most terribly, for vulnerable groups. Social workers consolidated a variety of limited resources to serve the needy, forming a community development approach (Lau et al. 2021).

Strengthening personal immunity is the basic element to optimising health status, and for which healthy lifestyle interventions (Monye and Adelowo 2020) are introduced. Diet and nutrition are essential, specifically regarding foods rich in protein, vitamins and minerals (Calcuttawala 2022), as well as paying attention to good food hygiene (Coelho-Ravagnani et al. 2021). Physical exercise is helpful in preventing chronic diseases, enhancing mental well-being, and reducing the severity of COVID (Castoldi et al. 2023, Cerasola et al. 2022). Sleep problems were reported during the pandemic (Silva et al. 2020). Breathing and relaxation exercises can improve sleep quality and mental health (Kepenek-Varol et al. 2022) because these techniques tend to favour immune functions (Mohamed and Alawna 2021). Social connection is conducive to physical and psychological health (Holt-Lunstad 2022). Keeping adequate social activities also enhance individual, family and social wellness. In contrast, tobacco and alcohol comprise proinflammatory or immunosuppressive molecular markers (Piaggeschi et al. 2021), and thus disrupt immunity (Calleja-Conde et al. 2021). Minimising the use of such substances is advisable.

Conclusion

Despite evidence of a negative correlation between vaccination rate and mortality rate (Smith et al. 2022), inoculation is not the only, or even a sufficient, intervention (Cheng 2022a); therefore, it is an untenable liability in connection to the high death rate in the fifth wave. Instead, distrust of the government remains the core component (Lau 2021). Although the government claimed that they had well prepared for fighting the Omicron strain (Hong Kong Government 2021), healthcare practitioners have blamed the authorities for under-preparation and feeble plans to defy this unprecedented public health battle. Issues of manpower, medical resources, management, policies and practices, and the balance between anti-pandemic measures, individual health (physical, mental and social) and economic development should be officially and comprehensively investigated in order to cope with similar future healthcare emergencies, while recognising that building mutual trust is a prerequisite condition for substantially addressing infectious diseases with minimal collateral damages.

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Unraveling Workplace Bliss: The Mediating Influence of Flow Experience in the Relationship between Psychological Needs Satisfaction and Happiness at Work

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The purpose of this paper is to report on the results of a study that sought to establish the mediating role of flow experience in the relationship between psychological needs satisfaction and happiness at the workplace, specifically within the context of public hospitals in Uganda. A cross-sectional study was conducted, involving a sample of 800 professional nurses. Findings reveal that flow experience partially mediates in the connection between psychological needs satisfaction and workplace happiness. Limitations include; the use of a mono-research methodological approach, suggesting opportunities for future research through interviews to triangulate findings. By way of practical implications, the study explicates the psychological needs of the healthcare professionals examined and contributes to a more positive work environment and consequently, higher levels of workplace happiness.

Keywords: *psychological needs satisfaction, happiness at work, professional nurses, health services, flow experience, and positive emotions*

Introduction

Employee happiness is a condition in which employees experience positive feelings at the workplace while undertaking their routines. It characterized by feelings of joy, vigor, and a smooth workflow in which they are able to balance their work routines with life experiences (Ilies et al. 2017, Waterschoot et al. 2020). In the wake of COVID-19 pandemic; organizations mostly in the developing world, whether public or private, are yet to reassure their employees of the happiness that directly affects their productivity. This now highlights the significance of the consideration of workplace happiness in the face of interested scholars. It is not surprising that nurses' happiness in Uganda's public hospitals does not present a contrasting narrative. Ideally, nurses in Uganda experience; inadequate leadership support, limited professional growth opportunities, exclusion from decision-making processes, insufficient protective equipment, low remuneration, high patient-nurse ratios, working with less qualified staff, insufficient resources, and a lack of recognition (Kabunga and Okalo 2021, Musiimenta et al. 2022) among others. These and more, laybare their persistent sense of dissatisfaction and discontent (Kawalya et al. 2019, Yu et al. 2018). However, what is amazing is that; despite extensive research on workplace happiness, there is a dearth of literature to indicate that the mediation role of flow experience has been

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considered in the relationship between psychological needs satisfaction and happiness at work (Kabunga and Okalo 2021, Musiimenta et al. 2022); above all in the unique context of Uganda's public hospitals' professional nurses. In order to formalize this investigation in the world of academia (Lester 2005), the following theoretical background has been adapted.

Theoretically, this study has adapted the Self-Determination Theory (Ryan and Deci 2002) to underpin the antecedents under consideration. The theory maintains that individuals experience happiness as along as their innate needs are achieved and these are; autonomy, competence and relatedness (Ryan and Deci 2002). By autonomy is meant the opportunity to live according to one's values. Competence implies the ability to pursue life goals and; relatedness has to do with feeling a sense of belonging. This implies that for one to be happy at the workplace the psychological needs specified above, have to be satisfied. This is the extent to which SDT anchors psychological needs satisfaction as an explanatory variable of happiness at work. Equally, this study argues that for an employee to be happy at work, he or she has to be skillful in face of work challenges, concentrated on the work beforehand and feel a sense of control over the work being done. This is what is called flow experience. These specific conditions are retained in a mind that feels autonomous, competent and related as nurtured by the SDT (Ryan and Deci 2002). To this extent, even flow experience, is arguably a construct of the SDT as it is conceptualized herein as a second explanatory variable of happiness at work. Interestingly however, even with the realization that both psychological needs satisfaction and flow experience are anchored by SDT, there is a dearth of literature to indicate that they have both been studied in relation to happiness at work. Besides, is the near absence of literature to implicate the potential mediation effect of flow experience as underpinned by SDT, in the relationship between psychological needs satisfaction and happiness at work.

The primary objectives of this paper are twofold: 1-To examine the relationship between psychological needs satisfaction, flow experience, and happiness at work among professional nurses. 2-To determine the mediating role of flow experience in the relationship between psychological needs satisfaction and happiness at the workplace.

Literature Review and Hypothesis Development

Psychological Needs Satisfaction, Flow Experience, and Happiness at the Workplace

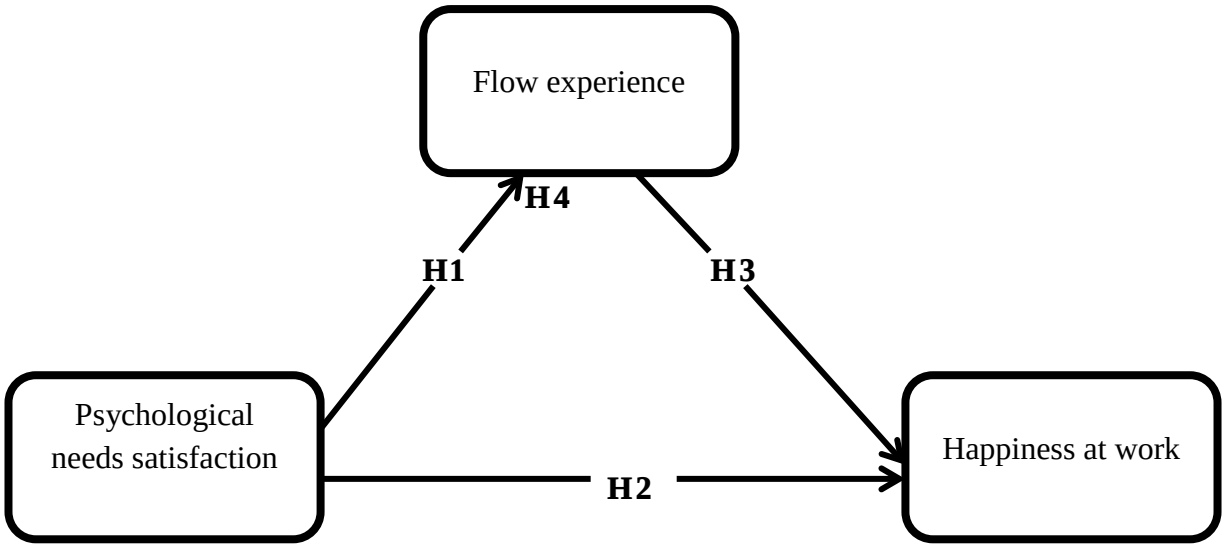
Existing literature indicates that psychological needs satisfaction, flow experience and happiness at work are related although with significant gaps that need to be addressed afresh. This is because; SDT proposes that individuals seek tasks that have the potential to achieve autonomy, competence, and relatedness as core inherent individual needs (Deci and Ryan 2000). Indeed, when one feels autonomous, competent to pursue his or her work and part of others in the process of undertaking the work assigned, there is a potential for him or her to feel a sense

of skillfulness in face of the challenges, concentrated to the extent that he is focused, and the essence of being in charge of the work delegated to him or her (Deci and Ryan 2000, Csikszentmihalyi 1997). However, at empirical literature level, there is limited scholarly evidence to that attest to the potential relationship both directly and indirectly inherent between and among psychological needs satisfaction, flow experience, and happiness at the workplace: Instead, psychological capital as opposed to psychological needs satisfaction; has been related to flow experience and happiness at work (Kawalya et al. 2019). Therefore, it was hypothesized that;

H1: There is a significant positive relationship between psychological needs satisfaction and happiness at work.
H2: There is a significant positive relationship between psychological needs satisfaction and flow experience.
H3: There is a significant positive relationship between flow experience and happiness at the workplace.
H4: Flow experience mediates in the relationship between psychological needs satisfaction and happiness at the workplace.

This conceptual framework below is underpinned by the associated SDT and this prompted the subsequent examination of the potential relationships both direct and indirect between psychological needs satisfaction, flow experience, and happiness at the workplace, particularly within the unique context of professional nurses in Uganda. The hypotheses set the stage for empirical investigation, contributing valuable insights to the existing literature on workplace well-being.

Figure 1. *The Model Arising out of this Literature Review, was Developed to Guide this Study*



Source: Adapted from Deci and Ryan 2000, Seligman 2002, Csikszentmihalyi 2001.

All the above assumed relationships (as illustrated in Figure 1 above) were tested and supported. The Automatic SPSS and AMOS software was used and the

partial mediation of the $p<0.005$ and significance of the mediation effect of flow experience in the relationship between psychological needs satisfaction and happiness at the workplace is indicated. The results are summarized in Figure 2.

Methods

Research Design, Population, Sample Size, and Selection Procedure

This study adopted a cross-sectional design. The population was 210,000 (Two hundred and ten thousand nurses employed in public hospitals in Uganda, in the selected public hospitals in the three (3) regions of Uganda that were investigated. These were: the central region, western, northern, and eastern regions. These regions were considered because; they have the highest numbers of public hospitals and professional nurses (Uganda Bureau of Statistics 2016). Out of these, a sample size of 384 (Krejcie and Morgan 1970) was obtained. The sampling techniques that were used included both purposive and convenience sampling approaches considering that even if the study targeted nurses in the stated regions of Uganda and in government hospitals, they had to declare their willingness to participate in the study until the required sample of 384 was obtained.

Variables Measurements, Data Collection Method and; Reliability and Validity Measurement of Variables

The study had three variables and these were: Happiness at work (DV); Psychological needs satisfaction (IV) and Flow experience (MV). There operationalization and measurements were as follows: Happiness at the workplace which was operationalized in terms of meaningfulness, personal engagement, life satisfaction, and positive emotions and this was in line with the works of Wörtler et al. (2020). Flow experience was measured in terms of challenge and skill balance, concentration on the task, and perceived control (Csikszentmihalyi 2005). Psychological Needs Satisfaction (PsyNS) was operationalized in terms of relatedness, competence, and autonomy, and this was in line with (Deci and Ryan (2000).

Data Collection Method(s)

The study used a closed ended questionnaire to enlist responses from respondents and it was a six point scale. Section A was an introduction, section B was about background information about the study respondents and C was about the questions related to the study objectives. Finally, all these were anchored on a six point likert scale because the response options for all the study variables were anchored on a six-point Likert scale ranging from 1=always without fail to 6= never less than a quarter of the time because, there was need to avoid undecided

responses from respondents who could have wanted to stick in the middle (Csikszentmihalyi 1997).

Reliability and Validity Tests

The questionnaire was tested for reliability and Cronbach (1951) and Hair et al. (2010), recommend a cut off of 0.7 and above as reliable. For this study, the Cronbach alpha coefficients were 0.85, 0.83, and 0.84 for happiness at the workplace, flow experience, and PsyCap respectively. For validity, questionnaires were given to experts in practice and various scholars on happiness. These made changes to the items and the questionnaire was revised accordingly. The questionnaire was given to the experts before going to the field. Therefore, the revised questionnaire was used for data collection and after data collection, Cronbach alpha was computed. Data management and analysis

Data Management

This was consistent with the recommendations by Field (2009). In particular, data were cleaned, coded, and entered into a statistical package for the social scientist's data editor. The data was analyzed through the Statistical Package for Social Scientists (SPSS) (Preacher and Hayes 2010). The authors of this study checked for missing values and outliers which are data points (observations) that do not fit the trend shown by the remaining data (Hair et al. 2012). Finally, 800 usable questionnaires were retained for final analysis. Note that outliers bias the mean and inflate the standard deviation (Field 2009). Field (2009) explains several options for dealing with outliers. These options include deleting the data from the person who contributed to the outlier, transforming the data, or changing the score and this involves changing the score to be one unit above the next highest score in the data set, calculating what score would give rise to a z-score of 3.29 or using the mean plus two times the standard deviation (rather than three times the standard deviation) (Field 2009).

In this study, outliers were dealt with by calculating what score would give rise to a z-score of 3.29 (or perhaps 3) by rearranging the z-score equation in section 1.7.4, which gives us $X = (z \times s) + X-$. All this implies that we calculated the mean (X-) and standard deviation (s) of the data; we know that z is 3 (or 3.29 if you want to be exact) so we just add three times the standard deviation to the mean, and replace our outliers with that score. Because the questionnaires were checked by the authors and research assistants before leaving the respondents, there were no missing values in the data set. The assumptions of normality, the linearity of data, and the homogeneity of variance were found to be tenable. For example, the assumption of homogeneity of variance was tested using Levene's test and for the variables of interest; Levene's test was not significant at $p > 0.05$.

According to Hair et al. (2010), the structural equation model (SEM) involves constructing a model that combines the manifest and latent variables of all the global variables into a single model for decision-making in AMOS through bootstrap. Hair et al. (2010) recommends that two competing model should be

constructed to determine the model that is better for decision-making. Additionally, Preacher and Hayes (2010) also recommend that the p-values should be used to determine the type of mediation effect that exists, and for full mediation, the $p<0.001$, and for partial mediation the $p<0.005$. Thus, to establish the mediating role of flow experience in the relationship between psychological needs satisfaction and happiness at the workplace, an SEM model combining the independent variable (psychological needs satisfaction), mediator variable (flow experience), and dependent variable (happiness at the workplace) was constructed. (As illustrated in Figure 2) The results are indicated in the next section.

Results

Sample Characteristics

The results from this study indicated that the majority (40%) of the respondents were in the 31-40 age brackets as compared to those who were in the 20-30 age brackets. Besides, the results also showed that the majority (77%) of the respondents were female as compared to the males who comprised 23%. Furthermore, the results also revealed that most (51%) of the respondents had attained a certificate level of education as compared to those with a master's degree (0.8%). In addition, the results also indicated that most of the respondents (62%) were located in the central region as compared to those from the western region (9%). Similarly, the results also showed that most (64%) of the respondents were general nurses as compared to the registered nurses who constituted only 1.6%. More so, the results also showed that the majority (62%) of the respondents were married as compared to 3.5% who were in a relationship.

Descriptive Statistics

Descriptive statistics were generated to show how the observed data fit well with the model developed under this study. The results from the descriptive statistics analysis indicated that the variable of psychological needs satisfaction had a mean = 1.85 and standard deviation = 0.805, while flow experience had a mean = 1.77 and standard deviation = 0.703, and happiness at the workplace at a mean = 1.71 and standard deviation = 0.803. The descriptive statistics results revealed that all the variables had their means not far from the standard deviation. This implies that the observed data fitted well to the model developed under this study since the means were far from the standard deviation as the measure of central tendency. Furthermore, statistics were also generated for the Skewness and Kurtosis. The rule of thumb is that the figures for both the Skewness and Kurtosis for normal data should range between -3.29 and 3.29 (Field 2009). However, Tabachnick and Fidell (2007) suggest that Skewness and Kurtosis statistics for normal distribution should range between -2 to +2 although a more lenient +3 to -3 can also show normality. The results from this study showed that Skewness and

Kurtosis statistics were achieved and tenable since they ranged between -2 to +2 as stipulated by Tabachnick and Fidell (2007). The results are indicated in Table 1.

Table 1. *Descriptive Statistics*

Variables	N	Min	Max	Mean		Std. Dev	Skewness Stat	Skewness Std err	Kurtosis Stat	Kurtosis Std err
Flow Exp.	800	1	6	1.77	.02485	0.703	1.457	0.086	3.991	0.173
PsyNS	800	1	6	1.85	.02849	0.805	1.213	0.086	2.444	0.173
Happiness	800	1	6	1.71	.02840	0.803	2.001	0.086	1.458	0.173

Source: Primary data (by authors, Automatic SPSS software generated).

Correlation Analysis Results

This is the second stage of analysis. It uses Pearson correlations analysis (shown in Table 2) to explore the relationship between predictor and outcome variables. The Pearson correlation coefficient and parametric statistics require interval data for both variables (Creswell 2009, Field 2009). This is to test its significance and normality. Parametric statistics assume that sample data comes from a population that follows a probability distribution based on a fixed set of parameters. The results here indicate that there is a significant positive relationship between psychological needs satisfaction and flow experience ($r=0.58^{**}$, $p\leq0.01$). This means that a unit change in psychological needs satisfaction may lead to a 0.577 change in flow experience in the same direction. This finding supports H1 which states that there is a significant positive relationship between flow experience and happiness at the workplace.

The results further indicate that flow experience is positively and significantly associated with happiness at work ($r=0.60^{**}$, $p\leq0.01$). This finding provides support for H2 which states that there is a significant positive relationship between flow experience and happiness at the workplace. Finally, psychological needs satisfaction and happiness at work are positively and significantly associated ($r=0.63^{**}$, $p\leq0.01$). This finding implies that an increase in the level of psychological needs satisfaction may lead to increased happiness at the workplace. This supports H3 which states that there is a significant positive relationship between psychological needs satisfaction and happiness at the workplace. The age which is treated as a control variable in this study was found to be negatively but significantly associated with happiness at work.

Table 2. *Correlation Analysis*

Variable	1	2	3	4
Psychological needs satisfaction (1)	1			
Flow experience (2)	$.58^{**}$	1		
Happiness at the workplace (3)	$.60^{**}$	$.63^{**}$	1	
Age (4)	$-.10^{**}$	$-.11^{**}$	$-.14^{**}$	1
Note. **. Correlation is significant at the 0.01 level (2-tailed). **p < .01.				

Source: Primary data (by authors. Automatic SPSS software generated).

To explore the relationships more robustly, Structural Equation Modeling (SEM) using AMOS 23 was undertaken. First, the measurement models for each

of the latent variables (psychological needs satisfaction, flow experience, and happiness at the workplace) were tested using Confirmatory Factor Analysis (CFA). All the models exhibited good fit for the data, thus meeting the criteria of Comparative Fit Index (CFI) and Incremental Fit Index (IFI) above .95, and Root Mean Square Error of Approximation (RMSEA) below .08. This allowed the latent variables to be used in a path model thereby simplifying interpretation (Fornell and Larcker 1981).

Testing for Mediation Using SEM Bootstrap Approach

Measurement Model

The measurement models were constructed before testing the mediation effect through the SEM bootstrap approach in AMOS (Preacher and Hayes 2008, Zhao et al. 2010). The measurement model was constructed to show how the manifest variables are linked well to the latent global variable of psychological needs satisfaction. The results indicated good model fit indices with Chi-square = 23.287; Tucker-Lewis index (TLI) = 0.978; Comparative Fit Index (CFI) = 0.988; Incremental Fit Index (IFI) = 0.988; Root Mean Square Error of Approximation (RMSEA) = 0.049. Besides, another measurement model was constructed to show how the manifest variables link well to the latent global variable of flow experience. The results indicated good model fit indices with Chi-square = 21.838; TLI = 0.893; CFI = 0.928; IFI = 0.9981; RMSEA = 0.098. Furthermore, a measurement model for happiness at the workplace was constructed to show how the manifest variables linked it. The results also indicated a good model fit indices with Chi-square = 69.690; TLI = 0.964; CFI = 0.975; IFI = 0.975; RMSEA = 0.047 (See Table 3).

Table 3. *SEM Competing Models for Non-Mediation and Mediation Effects*

Variables	**Non-mediated model**	**Mediated Model**
Flow exp. ← PsyNS	.738***	0.679***
Happiness ← PsyNS	.691***	0.373***
Happiness ← Flow exp.	.399***	0.141***
CMIN	23.287	49.116
Degrees of freedom (Df)	8	24
Probability (P)	0.003	0.002
Incremental fit index (IFI)	0.988	0.986
Tucker-Lewis index (TLI)	0.978	0.979
Comparative fit index (CFI)	0.988	0.986
Normed fit index (NFI)	0.983	0.973
Relative fit index (RFI)	0.967	0.960
RMSEA	0.049	0.036
Squared multiple correlations		
Happiness	0.218***	0.230***
Flow exp.	-	0.461***

Note: *n = 800; significance level: *** p<.0001*

Source: by authors. Automatic SPSS software generated.

SEM Model for Mediating Effect

The results (see Figure 2) of the structural equation model revealed a perfect model fit indices with Chi-square = 49.116; TLI = 0.979; CFI = 0.986; IFI = 0.986; RMSEA = 0.036. Besides, the results showed that there is a significant and positive relationship between psychological needs satisfaction and flow experience (β = 0.97, p-value = 0.0001). Thus, this supports hypothesis H1 of this study. Similarly, the results from this study indicated that there is a significant and positive relationship between psychological needs satisfaction and happiness at the workplace (β = 0.156, p-value = 0.001). This is in line with hypothesis H2 under this study. The results from this study also show that there is a significant and positive relationship between flow experience and happiness at the workplace (β = 0.138, p-value = 0.081). This lends support to hypothesis H3 of this study. Finally, the results indicate that flow experience significantly and positively mediates the relationship between psychological needs satisfaction and happiness at the workplace and it is a partial type of mediation effect (β = 0.096, p-value < 0.05) (Tables 4-5). This supports hypothesis H4 of the study. The inclusion of flow experience in the model explains 14 percent of the variation in happiness at the workplace. When flow experience is included in the model, it boosts the explanatory power of psychological needs satisfaction on happiness at the workplace by 9.6 percent (see Table 4).

Table 4. *Total, Direct, and Indirect Effects in a SEM Mediated Model*

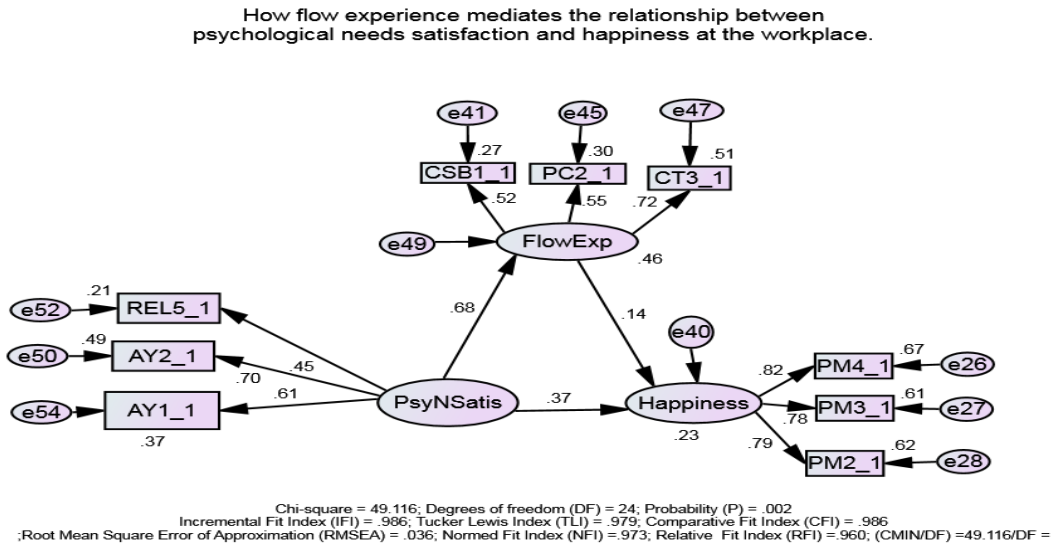
Standardized total effects	PsyNS	Flow exp.
Flow exp.	0.679***	0.000
Happiness	0.469***	0.141***
Standardized direct effects	PsyNS	Flow exp.
Flow exp.	0.679***	0.000
Happiness	0.373***	0.141***
Standardized indirect effects	PsyNS	Flow exp.
Flow exp.	0.000	0.000
Happiness	0.096***	0.000

Table 5. *Bootstrap Mediation Results*

Bootstrap mediation results:	**Point Estimates**	**SE**	**Lower Bounds**	**Upper Bounds**	**P**
PsyNS ← Happiness	0.695	0.193	0.360	1.101	0.001
Flow exp. ← Happiness	0.241	0.173	0.103	0.584	0.164
Flow exp. ← PsyNS	0.738	0.131	0.524	0.044	0.001

Note: *n = 800; significance level: *** p<.0001; ** p<.001; * p<.05*
Source: by authors. Automatic SPSS software generated.

Figure 2. *Final SEM Model for Mediation by Flow Experience*



Source: by authors, Automatic SPSS & AMOS software generated.
Note: RE-, Relatedness, AY,-Autonomy, PsyNSatis- Psychological Needs Satisfaction, FlowExp – Flow Experience, CSB- Challenge Skill Balance, PC- Perceived Control, CT- Concentration on the Task, PM- Positive Emotions.

Discussion

This study contributes to the existing literature on happiness at the workplace, psychological needs satisfaction, and the role of flow experience in the relationship between psychological needs satisfaction and happiness at the workplace. Based on the hypothesis (H1), this study finds that there is a positive relationship between psychological needs satisfaction and flow experience among professional nurses in public government hospitals in Uganda. The findings suggest that employees who are friends with co-workers experience concentration at work (Moore and Prentice 2013). Petri (2010) also argues that collegial relationships are all consistent with a more long-lasting flow experience. However, Moore and Prentice (2013) argue that a lack of interpersonal skills impedes collegial interactions in the workplace.

Therefore, the study argues that psychological needs satisfaction predicts flow experience.

Further, the results also reveal that there is a significant positive relationship between flow experience and happiness at the workplace. This confirms the hypothesis (H2) of the study. The study finds that flow experience leads to employees' contentment and meaningfulness in the workplace (Chitty and Black 2015). This finding is consistent with (Moore and Prentice (2013) who noted that skill variety relates to employee happiness. However, Van Hooff and Van Hooft (2017) argue that a lack of skills variety may induce boredom at work. This study argues that skill set/variety predicts joyfulness. This provides support for Psychology flow theory (Csikszentmihalyi 1990).

Based on the hypothesis (H3) of this study, the results revealed that there is a significant positive relationship between psychological needs satisfaction and happiness at the workplace. Duffy et al. (2013) and Wörtler et al. (2020) argue that psychological needs satisfaction is an important aspect in providing support to co-workers, and has a positive effect on employee contentment. Indeed as noted by Madlock and Booth-Butterfield (2012), when psychological needs satisfaction (relatedness, autonomy, and competence) is strong, employee's meaningfulness and engagement will be easily observed, thus, a feeling of happiness, which encourages friendships in the workplace.

Regarding H4 on the mediation role of flow experience, the results indicate partial and significant mediation effect of flow experience on the relationship between psychological needs satisfaction and happiness at the workplace, thus supporting hypothesis H4. This confirms that the presence of flow experience partly acts as a conduit in the association between psychological needs satisfaction and happiness at the workplace among professional nurses in public hospitals in Uganda. This then means that whereas psychological needs satisfaction is directly associated with happiness at the workplace, its contribution can be partly felt through flow experience. It also means that psychological needs satisfaction and flow experience are significant predictors of happiness at the workplace. Therefore, when professional nurses are not feeling bored, have skills to meet challenges, get involved in hospital activities, persevere, and feel free to express ideas, it may enhance a powerful urge in them to care for patients and be joyful. This finding is consistent with Bakker and Demerouti (2017), who argue that employees who are competent and balance their work challenges usually have a sense of meaningfulness at work. This finding also supports PsyFT (Csikszentmihalyi 1975), which argues that concentration on the task, and balancing challenges and skills promotes personal engagement and meaningfulness.

Conclusion

The current study examined the relationship between PsyNS and happiness at the workplace and the mediation role of flow experience in the relationship between PsyNS and happiness at the workplace. Through the self-administered questionnaire, 800 professional nurses were selected in Uganda's 3 regions,

central, western, and northern, to be part of the study. The current study hypothesized that there is a positive relationship between PsyNS and flow experience, PsyNS and happiness at the workplace, and flow experience and happiness at the workplace. We also hypothesized that flow experience mediates the relationship between PsyNS and happiness at the workplace. Our results supported the hypotheses developed. This current study, recommends that those in charge of public hospitals in Uganda should not just focus on employee happiness, but should consider the flow experience of professional nurses. This is because flow experience has been found in this paper to have a significant impact on professional nurse's happiness. As flow experience increases, professional nurses are more engaged and happier.

The study combined two theories; SDT and PsyFT by Fredrickson (2001) and Ryan and Deci (2002) respectively, to explain happiness at the workplace. Therefore, the integration of the two theories has provided a more robust understanding of happiness at work and what explains it. This study is beneficial to human resource managers of public hospitals who deal with health employees. They should redesign the recruitment system and policies that can boost PsyNS and flow experience to promote happiness at the workplace among professional nurses in Uganda.

Like any other study, this study also has limitations which are discussed alongside suggestions for future studies. First, the research only considered professional nurses in the public health sector in Uganda and did not consider other categories of medical workers, like medical doctors, clinical officers, administrators, support staff, and even professional nurses in private medical practice. These could be used as samples in future studies. This research only focuses on two factors that predict happiness at the workplace: PsyNS and flow experience. Future studies can consider other factors that predict happiness at the workplace, such as environmental factors and self-driven personality (Csikszentmihalyi 2005, Luthans 2002) among other factors. Future researchers should be interested in finding out other factors that predict happiness at the workplace in developing countries like Uganda. Hence, the implementation of autonomy, relatedness, and competence must be aligned with the organization's strategic goals like employee happiness at the workplace. In addition, this study focused only on cross-sectional data, thus, a longitudinal study and experiments may be used. Besides, the current study was purely quantitative, therefore a qualitative survey or a mixed methods design may be utilized in the future.

List of Acronyms

PsylNS: Psychological Needs Satisfaction
HWP: Happiness at the Workplace
SEM: Structural Equation Modelling
AMOS: Analysis of Moment Structure
SDT: Self Determination Theory

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