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enquaries@leaders-schools.com
www.leaders-schools.com

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Dr Tumelo Tlhoiwe
VICE CHANCELLOR

Vice Chancellor's Message To DDT academics Family and the Nation at large During this COVID-19 Pandemic

The whole world has been affected by Coronavirus, economies have shrunk, loved ones lost but our good lord has sustained us. I encourage everyone to consider research as a priority in order to come up with solutions to fight this pandemic.

The struggle you are in today is developing the strength you need for tomorrow. Being challenged in life is inevitable, but you have the choice to decide how you will react to the situation. Especially now, in this time of covid-19 crisis and uncertainty, change the changeable and accept the unchangeable. We may not be able to see it in the moment, but everything happens for a reason. Use this time to make a difference in your life or in the lives of someone else. Work on all areas of personal growth, spend quality time with family, and focus on goals for the future.

Train yourself to find a blessing in everything, Someone once said these words to me, which have stayed in my mind throughout my life. I truly believe that we are not put into a situation that we cannot conquer. Seeing the light in the midst of darkness is a lesson we all should learn, not only during this difficult time, but all the time. Stay focused on the good and making it better. It can only go up from here.

It's tough to see the light in times of darkness. My advice for all researchers and students is to continue to be positive and never give up hope. It's when we start to lose hope that we begin to struggle mentally. Lend a listening ear to everyone; sometimes all someone needs is a person willing to listen. We all need to come together in this time and continue to check on loved ones, friends, teammates, roommates, and classmates. You never know the impact of what a simple 5 minute phone call could do for someone. Spread that love each and every day.

"Life throws you curves but you learn to swerve." No one is ever really prepared for God's greater plans, but we figure it out, taking it one day at a time. During my time at university, there were some unfortunate events, but we always came together as a community to get it through it as one. Now more than ever, we need to take care of each other. Luckily we live in a world we can talk with friends and family virtually. Take care of yourself and your loved ones. We'll all look back on this time and remember the ones who helped us through this challenging time.

"Nothing in life is to be feared, it is only to be understood. Now is the time to understand more, so that we may fear less."

"A life lived in fear is a life half lived."

VC

Dr Derrick D. Tlhoiwe
CHANCELLOR

Chancellor's Message

To all academic fraternity of DDT College of medicine and beyond, I would like to thank every one of you for your contribution in building Our University college. Thank you for believing in our vision.

DDT continues with its vision as the top medical university in Botswana and draws inspiration from the government of Botswana which has encouraged every citizen to migrate from a minerals-led to a knowledge-based economy, DDT aspires to bring knowledge to Batswana by engaging in state of the art research work and bring solutions to challenging health problems such as the covid-19 pandemic.

Yes our journey has not been smooth, we all understand, "The size of your success is measured by the strength of your desire; the size of your dream; and how you handle disappointment along the way." Disappointments are just God's way to saying 'I've got something better'. Be patient, live life, have faith." We shall overcome every barrier ahead of us for ours is a noble task of improving the lives of Batswana.

I encourage everyone of you to commit to research work, Desire to face the challenge in solving the unsolved problems, concern over practical problems initiates research; Desire to get intellectual joy of doing some creative work; Desire to be of service to society; Desire to get respectability due to your creativity and innovation.

Covid-19 has ravaged many economies, I therefore encourage everyone of you to dedicate considerable amount of time in coming up with solutions to curb this pandemic.

DDT will set aside substantial amount of resources to go into each faculty research work. Your commitment to research will also build your promotion ladder to senior lecturer, assistant professor to full professor.

Last but not the least, I encourage you once again to remember that, The road to success and the road to failure are almost exactly the same it depends on the one you want embrace, Success is not final; failure is not fatal: Opportunities don't happen. You create them , It is the courage to continue that counts. It is better to fail in originality than to succeed in imitation. There are two types of people who will tell you that you cannot make a difference in this world: those who are afraid to try and those who are afraid you will succeed.

Chancellor

Contributors

Featured Contributors

Dr Derrick D. Tlhoiwe
Dr Tumelo Tlhoiwe
Ogorogile Mokate
Paul Moyo
Dr Carlos Alberto Justo Sedeno
Kabo O. Tshiamo
Raymond Chibvongodze
Dr Martinson Danquah
Dr Tapfuma Mudawarima
Suwilanji Chisenge
Dr Larry L. Mweetwa
DDT 2019 Final Year Students

Administrative Assistance

Gofaone R. Masake
Katlego V. Kenosi

Executive Editor

Dr Larry L. Mweetwa

Supporting Partner

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ANALYSIS OF COVID-19 FIRST GENERATION VACCINES DESIGN VIRAL PLATFORMS USED.

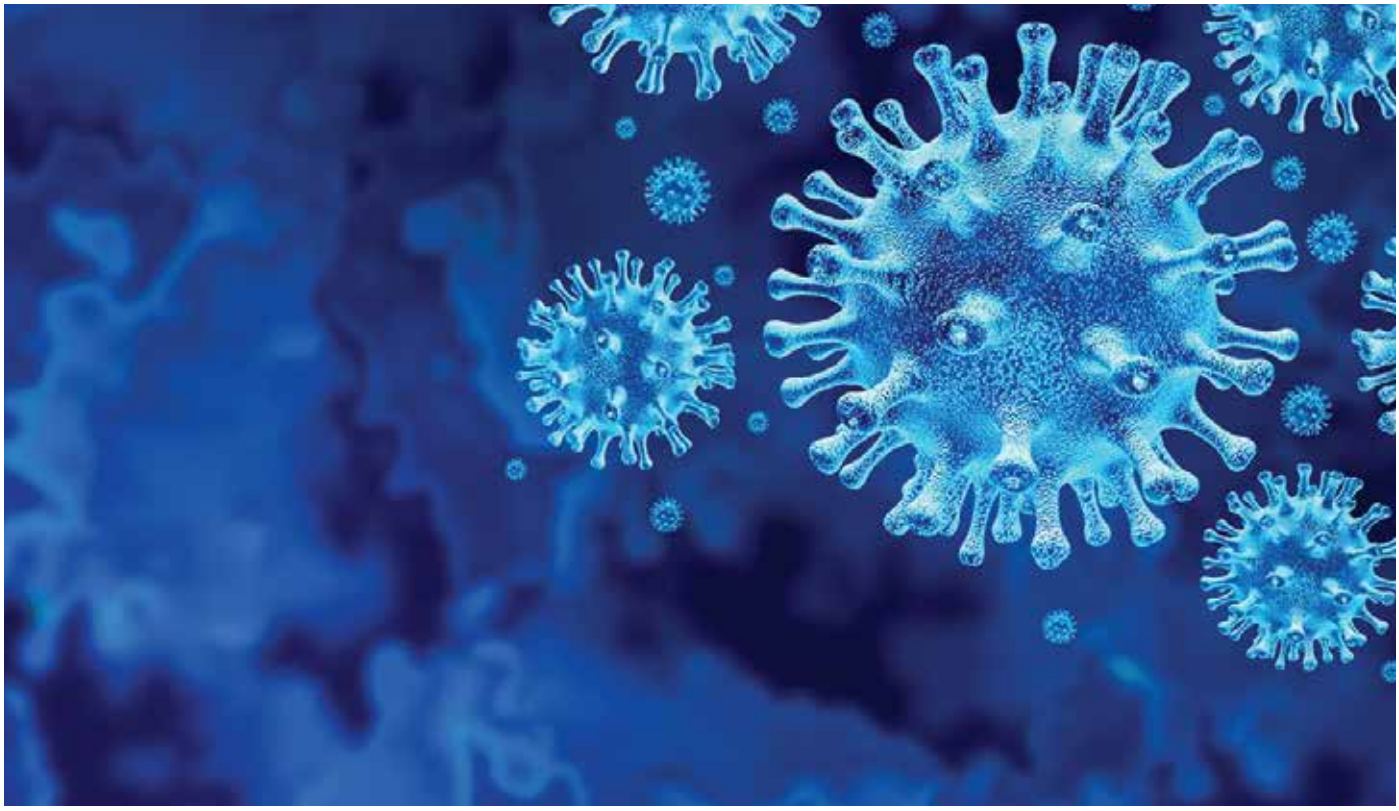
Author: *Larry.L. Mweetwa*

1. Department for Medical Laboratory Science, DDT College of Medicine.

2. Department of Medicine, DDT College of Medicine.

DDT College of Medicine,
P.O. Box 70587, Gaborone Botswana
Tel: +267(0)3904924/5
Cell: +267(0) 7710000
Fax: +267(0)3904935

Corresponding Author *Larry.L. Mweetwa*
Email: *enquiries@ddtcollegeofmedicine.com*



Abstract:

Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) or Coronavirus was initially detected in Wuhan, China in December 2019 and has subsequently resulted in the COVID-19 pandemic. The disease presents asymptomatically in some of individuals yet also causes symptoms ranging from those associated with influenza and pneumonia, acute respiratory distress syndrome (ARDS) and even death. The world is currently relying on physical (social) distancing, hygiene and repurposed medicines; however, it is predicted that an effective vaccine will be necessary to ensure comprehensive protection against COVID-19. There has been a global effort to develop an effective vaccine against SARS-CoV-2 with approximately 300 vaccines in clinical trials, and over 200 more in different stages of development. This review provides insight in respect of vaccines, which are in clinical use as of December 2020 and focusses on the Pfizer/ BioN-Tech/Fosun, Moderna mRNA-1273 and AstraZene-ca/Oxford AZD1222 vaccines.

Keywords: Coronavirus; Vaccines; AstraZeneca; Moderna (mRNA-1273); Pfizer, Johnson and Johnson, Gamaleya, Sinopharm, Viral Vector, Sputnik.

1.Introduction

In December 2019 a Coronavirus (COVID-19) outbreak was identified in Wuhan, China which subsequently spread across the globe. The COVID-19 pandemic has been attributed to the acute respiratory syndrome coronavirus-2 (SARS-CoV-2) and exhibits a range of the clinical symptoms some of which are similar to influenza, include acute respiratory distress syndrome (ARDS) and pneumonia in addition to presenting with asymptomatic patients and all may ultimately result in mortality [1]. Initially the pandemic was perceived to be simple to manage with interventions such as physical (social) distancing, use of masks, adequate use of other personal protective approaches including hand sanitizer and face mask use however, at the same time and it was anticipated that the use of existing and new antiviral drugs, and effective vaccines would reduce mortality rates of COVID-19. Perhaps the initial naïve perception that the development of herd immunity through natural development of immunity through infection was the contributor to significant loss of life due to death [1]. By way of example, in Sweden, the authorities presumed that if 60% of the total population had been infected the resultant herd immunity would be adequate to

The comparison of number of infections eliminated by use of the vaccine in the other group was carried out by analysing the difference between r2 and r1 and in this case, it was established that the AstraZeneca vaccine was 73% effective and facilitates removal of 73% of cases which would otherwise occur.

protect the population [1,2].

However, this presumption failed, and a significant number of the Swedish population have since lost their lives due to COVID infection [2]. Consequently, the development of an efficient vaccine has been perceived as the only practical way to ultimately establish herd immunity on the globe. Researchers across the globe have been developing a vaccine for COVID-19 resulting in many vaccine candidates e in different stages of development of which some are in Phase 1 clinical trials [3].

The development of a safe and effective vaccine requires pre-clinical and clinical trials be conducted to minimize the potential of severe adverse effects when used on a large scale [3]. This review will focus on the current vaccines in which a summary of the biological and immune responses observed from previous COVID-19 infections and SARSCoV-2 is provided. In addition, this review describes exploratory and pre-clinical stages of SARS-CoV-2 vaccine development and a discussion regarding the target platform for designing an effective and safe COVID-19 vaccine with relevant clinical trial data. Furthermore, the ethical concerns surrounding the development and production of these vaccines is considered.

2. Immunogenicity to SARS-CoV-2

Recovery following SARS-CoV-2 infection requires a strong immune response and individuals infected with COVID-19 exhibit a strong immune response to the virus which also facilitates their convalescence [4,5]. Current evidence suggests that helper T cells in COVID-19 infected individuals recognise e spike proteins on the SARS-CoV-2 viral architecture. Consequently, T cells play a significant role in elimination of SARS-CoV-2 from the human body [5]. Moreover, the structure of SARS-CoV-2 includes a major trimeric glycoprotein envelope or S-protein located on the surface of the virus facilitating binding to host cells making it a primary target for the development of a successful vaccine.

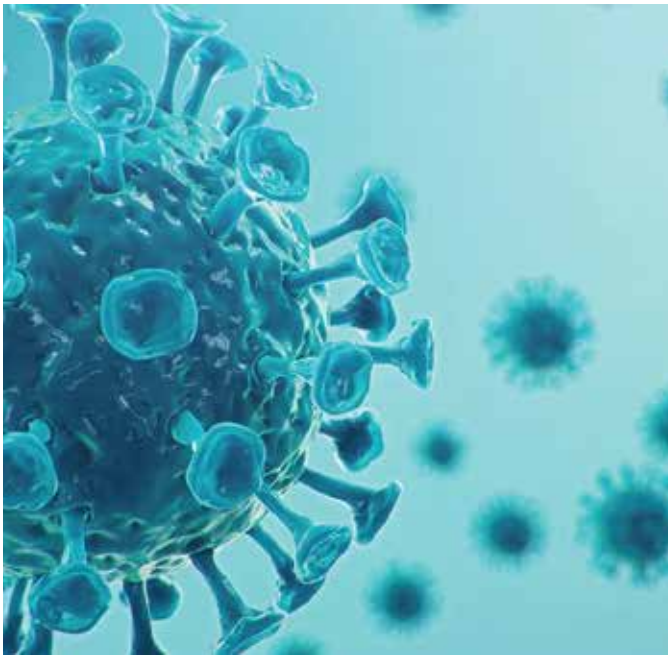
The AstraZeneca COVID-19 (AZD1222) coronavirus vaccine has been developed from a version of the common cold adenovirus [6]. The vaccine contains ChAdOx1, which includes the genetic sequence of the SARS-CoV-2 surface spike (S) protein.The S-protein located on the surface of SARS-CoV-2 is essential for the SARS-CoV-2 virus to infect host cells [6]. Most of the vaccines currently in clinical use have been developed using lipid nano particle-encapsulated mRNA, adenovirus 5 vector that expresses S-protein DNA, nucleoside modified RNA (modRNA) uridine containing Mrna (saRNA), electroporation of DNA plasmid encoding S protein, inactivated virus following viral propagation in cells with a SARS-CoV-2 clinical strain, lentiviral vector dendritic cells modification (LV-DCs and antigen-specific cytotoxic T lymphocytes (CTL) approaches and are schematically represented in Figure 1, the SARS-CoV-2 spike protein binds to ACE2 receptors in order to enter and infect human cells.

The production of a vaccine using spike protein may prime the immune system to attack the coronavirus in subsequent infections.

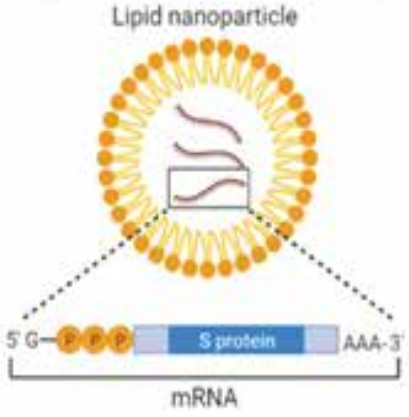
The spike protein is a major surface protein on the CoV virion and is the primary target for neutralising antibodies [7]. The S-protein undergoes dramatic structural re-arrangement when fusing the virus to the cell membrane of the host for viral genome delivery into the target cell. The 2 proline substitutions (2P) on the apex of the central helix stabilises the MERS-CoV, SARS-CoV and HCoV-HKU1 S protein [7].

The release of the SARS-CoV-2 sequence into the hose cell immediately triggers the manufacture of mRNA which expresses the prefusion-stabilised SARS-CoV-2 spike material (fig. 1) [8]. The mRNA-1273 induces potent neutralising antibodies and CD8 T-cell responses and provides protection against SARS-coV-2 [8]. Therefore mRNA-1273 detects and encodes the SARS-CoV-2 prefusion-stabilised spike protein.

BNT162b2 is lipid-nanoparticle formulation containing 5 nucleoside-modified RNA (modRNA) 6 which facilitates encoding of the full-length spike of SARS-CoV-2 [9]. The encoding is modified by two proline mutations for locking into the prefusion confirmation. The doses of BNT162b2 used result in high SARS-CoV-2 neutralising antibody levels in addition to responses from antigen-specific CD8+ and Th1-type CD4+ T-cells as depicted in Figure

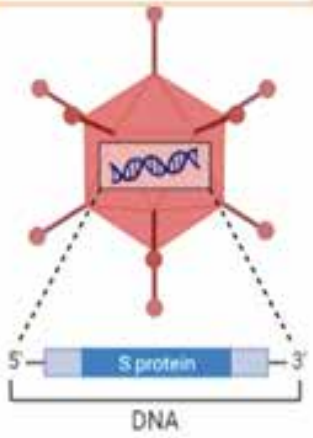


Moderna (mRNA-1273



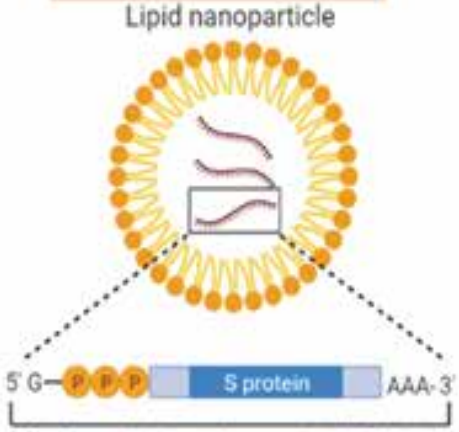
Platform: LNP-encapsulated mRNA encoding S protein.

AstraZeneca/Oxford's AZD 1222



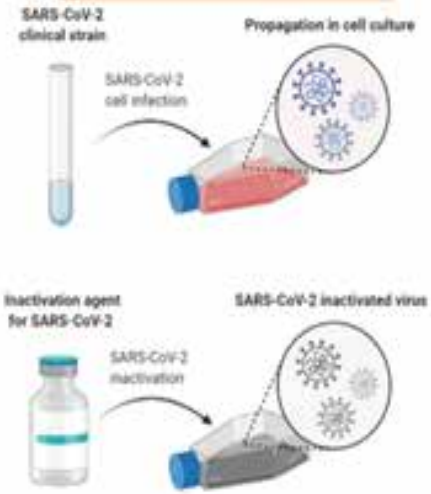
Platform: Adenovirus type 5 vector that expresses S protein.

Pfizer-BioNTech



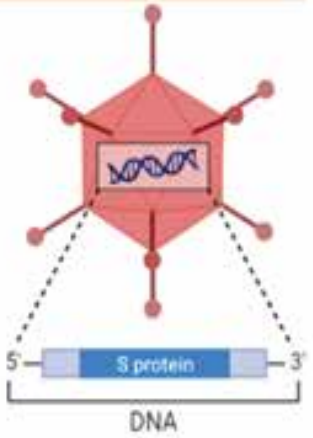
Platform: Nucleoside modified RNA (modRNA)
Uridine containing mRNA (uRNA)
Self-amplifying mRNA (saRNA)

Sinovac Biotech (Sinopharm)



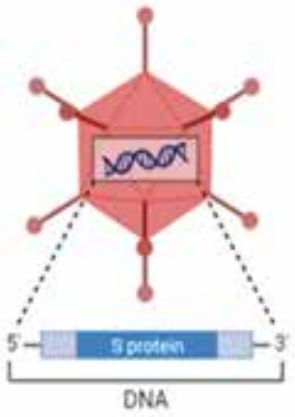
Platform: Inactivated virus vaccine produced from viral propagation in cells infected with a SARS-CoV-2 clinical strain.

Gamaleya (SputinK V)



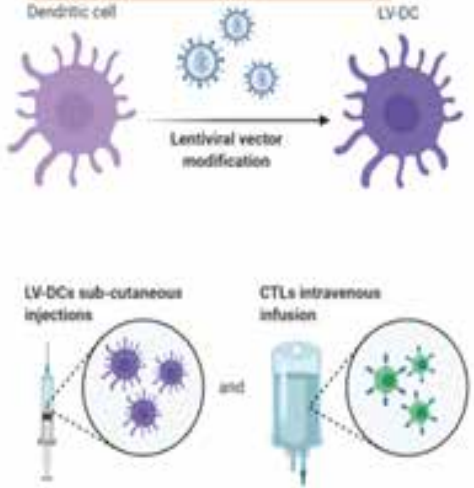
Platform: Adenovirus type 5 vector that expresses S protein.

Johnson and Johnson (Ad26.COV2.S)



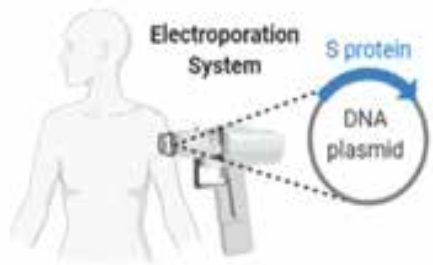
Platform: Genetically modified Adenovirus vector type 5 vector that expresses on S protein and uses double-stranded DNA.

Shenzhen Medical Institute (LV-SMENP-DC)



Platform: Lentiviral vector modification of dendritic cells (LV-DCs) and antigen-specific cytotoxic T lymphocytes (CTLs).

Inovio Pharma (INO-4800)



Platform: Electroporation of DNA plasmid encoding S protein.

3. Exploratory and Pre-Clinical Studies of SARS-CoV-2

Normally the development of new vaccines usually takes between 10 and 15 years whereas the development of a vaccine for COVID-19 over 12-24 months was astounding . The initial vaccine development phase or exploratory stage includes fundamental laboratory research augmented with computational modelling [11] to facilitate identification of natural or synthetic antigens which can be used as vaccine candidates. The second stage of the process includes pre-clinical studies in which cell or tissue culture and human model-based trials are used to establish the safety and immunogenicity of the test vaccine and/or an ability to provoke an immune response [12]. Initially safety, efficacy and immunogenicity are demonstrated in animal models after which clinical trials in small cohorts of human subjects are undertaken [12].

Due to the urgent need to develop prophylactic approaches against COVID-19, several vaccine candidates progressed to the clinical trial stage of development prior to demonstrating efficacy in animal models and provided the idea of pre-clinical research data were used to evaluate the Moderna mRNA vaccine candidate [13]. Vabret et al., the immunisation of mice with mRNA encoding alleviated perfusion and mediates CD8+ T cell response, whilst exhibiting dose-dependent neutralisation SARS-CoV-2 spike trimers by antibodies [14]. Two doses of the mRNA provided in a prime-boost combination to the mice prevented nasal mucosa and lung infections, after challenging SARS-CoV-2 infected mice, however, the trial did not show enhancement of immunopathology in animals receiving sub-protective doses [14].

4. Technology for COVID-19 Vaccine Design

There are many technologies being considered for COVID-19 vaccine development, including DNA, RNA, non-replicating viral vectors and inactivated vaccines [15]. DNA and RNA based vaccines were not developed aggressively nor licenced for human use previously therefore DNA and RNA based vaccines may not be an advantage during a pandemic situation [15]. However, in the light of available evidence DNA and RNA platforms do not require bioreactor culture techniques for production of an inactivated vaccine, and are easily developed in a laboratory as they are based on the genetic sequence of the virus [16]. For this reason DNA and RNA based vaccines for Covid management are under investigation [16]. In contrast non-replicating viral vaccines have been proven safe and effective and can be manufactured on a large scale [17]. As there is an urgent need for a COVID-19 vaccine in the current pandemic situation several DNA, RNA and non-replicating vaccines have been investigated using DNA and RNA platforms.

4.1 RNA Based Vaccines

4.1.1 Moderna mRNA-1273

Moderna is a US-based company that has developed a mRNA-based vaccine referred to as mRNA-1273 [18]. This vaccine codes for the production of spike proteins and administration of the vaccine results in immune cells present in the lymph nodes performing processing of mRNA, resulting in the marking of the protein in humans. The protein is subsequently recognised and marked for destruction. [18]. The Moderna vaccine forms part of the Operation Warp Speed initiative for accelerating the production of a usable vaccine. The preliminary Phase I trial data released by Moderna revealed that the vaccine, tested on mice by immunising them with the doses of 0.01, 0.1

or 1 µg, demonstrated a high pseudovirus NAb response with the 1 µg dose [13]. Moreover, the pseudovirus NAb response was also observed in mice who expressed a mutated form of the spike protein viz., D614G. The 1 µg dose demonstrated a robust and cytotoxic response by T-cells, and balanced responses of Th1/Th2 [13]. The mice did not exhibit increased pathology following administration of the 1 µg dose of vaccine. The Nab levels in mice in response to the 1 µg dose were comparable to that of a 100 µg dose in human subjects with the result that a 100 µg dose was considered necessary for carrying large scale efficacy trials.

4.1.2 BioNTech BNT162

The collaboration between the German company BioNTech and American company Pfizer resulted in the development of an mRNA-based vaccine for encoding the RBD domain of the SARS-CoV-2. The BNT162 product incorporates modified mRNA and includes a trimerisation domain derived from T4 fibritin [19]. For the phase I trial 45 healthy volunteers who were separated into groups to receive 10 µg, 30 µg, and 100 µg doses, were recruited and 9 participants received a placebo dose [19]. On the basis of the interim data, the participants demonstrated an increased level of IgG, which increased and remained elevated for 14 days following the second dose [19]. Individuals who received the 100 µg dose did not exhibit an increase for one day after vaccination, and exhibited peak IgG levels at 21 days following the initial dose [19]. The individuals who received the 100 µg dose did not receive the second booster dose and based on this information no difference between the health outcomes of individuals who received doses of 30 µg and 100 µg were observed [19].

4.2 Non-Replicating Viral Vectors Vaccines

The University of Oxford in partnership with AstraZeneca, a British pharmaceutical company, developed a viral vaccine, previously referred to as ChAdOx1. The pre-clinical trials for this vaccine were undertaken in a porcine model with a large antibody response observed [20]. A randomised controlled trial with 1077 healthy individuals was performed in the UK with participants receiving either 5 × 1010 vaccine particles or the meningococ

cal vaccine MenACWY [21]. The participants were further subdivided and categorised on the basis of paracetamol prophylaxis as this was used as a to reduce adverse events. The production of a recombinant adenovirus for ChAdOx1 nCoV-19 was undertaken and administered at a dose of 5 × 1010 viral particles dose by intramuscular injection [21]. Local and systematic events were fewer in individuals in the paracetamol group when compared to those individuals who received no prophylaxis [21]. However, liver enzyme upregulation through paracetamol use was not considered in this evaluation.

4.3 DNA-Based Vaccines

The American company Inovio developed the DNA-based INO-4800 vaccine. which is injected into the dermis after which electroporation is applied to ensure uptake into cells. The participants were divided into two groups who were administered a high (2mg) or low (1mg) dose [22]. The analysis of adverse events revealed that 28% of the individuals experienced Grade I adverse events after two months [22].

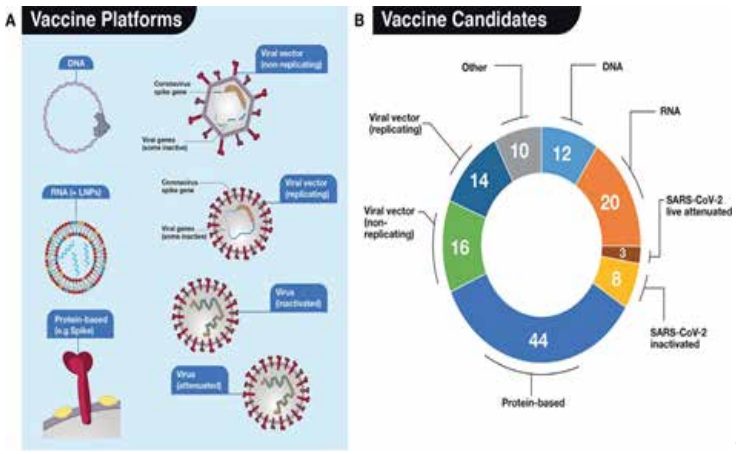


Figure 3: Vaccine platforms and candidates for SARS-CoV-2 and the COVID-19 (Adapted from Funk et al. [23])

5. Unpacking clinical trials data for SARS-CoV-2 vaccines currently under investigation

5.1 mRNA-1273

The primary endpoint for establishing the efficacy of the mRNA-1273 vaccine is the prevention of COVID-19 symptoms within at least 14-days following a second injection [24]. The efficacy levels of the mRNA-1273 were analysed and the consistency of the vaccine at the primary endpoint evaluated in subgroups for age, e health-related risk for severe disease, gender, race, and ethnic groups in addition to risk for COVID-19 [24]. A secondary endpoint was defined in terms of mRNA-1273 efficacy in preventing severe COVID-19, with reference to pre-defined criteria which included a respiration rate of > 30 breathes per minute, heart rate of > 125 beats per minute, oxygen saturation of 93% or lower less (the oxygen partial pressure to the oxygen reaction inspired ratio of < 300 mm Hg), acute respiratory distress syndrome and respiratory failure [24]. The criteria used included clinically significant neurologic, hepatic, renal dysfunction in addition to admission history to the intensive care unit. Some additional secondary endpoints included the efficacy of the vaccine to prevent COVID-19.Of interest solicited adverse events at the injection site were more frequent in the mRNA-1273 group compared to the placebo group [24]. Following the first dose, solicited adverse events totalled 84.2% in the mRNA-1273 and 19.8% in the control groups whereas, following the second dose the solicited adverse events were 88.6% in the mRNA-1273, and 18.8% in the control groups. The severity of injection site events in the mRNA-1273 group were reported as grade 1 and grade2 and observed more frequently in individuals who were SARS-CoV-2 positive at baseline when compared to subjects who were negative at the baseline [24].

The efficacy of mRNA-1273 vaccine was calculated by determining the difference in ratio of infected individuals in the control and vaccinated groups, respectively.

The number of individuals in the vaccine group was n1= 15000 and in the control group n2= 15000. In the vaccinated group, x1=11 individuals were infected by the virus, whereas in the control group x2=185 individuals were infected by the virus during the study [24]. The ratios of the infected individual within the vaccine group, 'r1' was 0.000733, whereas the ratios of the infected individual within the control group, 'r2' was 0.012333. The analysis of ratio of infection in the mRNA-1273, and placebo group revealed that a greater number of individuals were infected in the control group. Efficacy was determined by considering the difference in the ratios 'r1'and 'r2', which revealed that mRNA-1273, vaccine was 94% effective and facilitates removal of 94% of cases which would otherwise occur.

$$r1=x1/n1$$
$$r1=11/(15000\ )$$
$$r1=0.000733$$
$$r2=x2/n2$$
$$r2=185/15000$$
$$r2=0.012333$$
$$E=(r2-r1)/r2$$
$$E=(0.012333-0.000733)/0.012333$$
$$E=0.94$$
$$E=94\%$$

Where,

n1= Number of individuals in control group
n2= Number of individuals in vaccinated group
x1= Number of individuals in control group infected by virus
x2= Number of individuals in vaccinated group infected by virus
r1= Ratio of individuals in control group infected by virus to the total number of individuals in the control group
r2= Ratio of individuals in vaccinated group infected by virus to the total number of individuals in the vaccinated group
E= Difference in the ratios of infected individuals in the control and vaccinated groups.

5.2 BioNTech BNT162

The efficacy of the BNT162b2 vaccine by considering primary and secondary endpoints was reported by Polack et al. [9]. The primary endpoint was efficacy of BNT162b2 against confirmed cases of COVID-19 within at least 7 days onset following administration of the second dose and secondary endpoints included the efficacy of BNT162b2 against severe COVID-19 infection [9]. The effectiveness of the vaccine was estimated using,

Where,

IRR is the ratio of confirmed cases of COVID-19 illness per 1000 individuals.

Analysis of reactogenicity revealed that recipients of the BNT162b2 vaccines exhibited more local reactions and mild to moderate pain at the site of injection within seven days of treatment when compared to the placebo group [9]. Analysis of systemic reactogenicity revealed that events including headache and fatigue were experienced by 59% and 52% of the younger participant in the BNT162b2 group, whereas the event rate in the placebo group was comparatively lower after the first and second doses [9].

The number of individuals in the vaccine group was n1= 21720 and the control group n2= 21728. In the treatment group x1=8 individuals were infected by the virus, whereas, in the control group x2=162 individuals were infected by the virus [9]. The ratios of the infected individual within the vaccine group, 'r1' was 0.000368, whereas, the ratios of the infected individual within the control group, 'r2' was 0.007456. Analysis of the ratio of infection in the BNT162b2, and placebo groups revealed that a greater number of individuals were infected in the control group. In the analysis of data if the control group provides the rate of infection in the absence of using a vaccine, the number of infections eliminated by use of the vaccine in the other group is established by comparing the difference between r2 and r1 and in this case, it was found that the BNT162b2 vaccine was 95% effective and facilitates removal of 95% of cases which would otherwise occur

r1=x1/n1
r1=8/(21720)
r1=0.00036
r2=x2/n2
r2=162/21728
r2=0.007456
E=(r2-r1)/r2
r2=(0.007456-0.000368)/0.00
7456
E=0.95
E=95%

Where,
n1= Number of individuals in control group
n2= Number of individuals in vaccinated group
x1= Number of individuals in control group infected by virus
x2= Number of individuals in vaccinated group infected by virus
r1= Ratio of individuals in control group infected by virus to the total number of individuals in the control group
r2= Ratio of individuals in vaccinated group infected by virus to the total number of individuals in the vaccinated group
E= Difference in the ratios of infected individuals in the control and vaccinated groups.

5.3 AstraZeneca

According to the MHRA Information for Healthcare Professionals [25], the levels of protection following a single dose of the AstraZeneca vaccine were evaluated by exploratory data analysis by including participants who had received one dose of the vaccine [25]. Participant data were removed from the analysis performed as soon as possible following administration of the second dose, 12 weeks after the first dose [25].

Vaccine efficacy analysis revealed that 22 days post-dose, efficacy of the vaccine was 73% with 95% CI limits of 48.79 and 85.76 [25]. It was also observed that hospitalisation was reduced from 21 days after the first dose up to two weeks after the second dose. Consequently, it is likely that a single dose of the AstraZeneca vaccine will provide short-term protection against COVID-19 infection [25]. Protective immunity from the first dose was reported to last for up to 12 weeks. Exploratory analyses suggest that increased immunogenicity was highly correlated to a longer dose interval. In this exploratory trial the number of individuals in the vaccine group was n1= 7998 and the control, group n2= 7982 [25].

In the vaccinated group x1=12 individuals were infected by the virus following treatment whereas, in the control group, x2=44 individuals were infected by the virus. The ratio of infected individual within the vaccine group, 'r1' was 0.001500, whereas the ratio of the infected individual within the control group, 'r2' was 0.005512. Analysis of the ratio of infection with the AstraZeneca vaccine and placebo groups revealed that a greater number of individuals were infected in the control group.

r1=x1/n1
r1=12/(7998)
r1=0.001500
r2=x2/n2
r2=44/(7982)
r2=0.005512
E=(r2-r1)/r2
E=(0.005512-0.001500)/0.005
512

E=0.72786
E=73%

Where,
n1= Number of individuals in control group
n2= Number of individuals in vaccinated group
x1= Number of individuals in control group infected by virus
x2= Number of individuals in vaccinated group infected by virus
r1= Ratio of individuals in control group infected by virus to the total number of individuals in the control group
r2= Ratio of individuals in vaccinated group infected by virus to the total number of individuals in the vaccinated group
E= Difference in the ratios of infected individuals in the control and vaccinated groups.

6. Uncovering Clinical Data

6.1 Johnson and Johnson

The efficacy and safety of the Janssen COVID-19 candidate vaccine for protection against moderate to severe COVID-19 was evaluated in a phase 3 clinical trial by considering co-primary endpoints of 14 and 28 days after vaccination [26]. It was found that the Janssen candidate was 66% effective for the prevention of moderate to severe COVID-19 at 28 days after vaccination. A single dose of the Johnson & Johnson vaccine showed a 66% percent effectiveness at preventing moderate to severe disease from COVID-19 and 85% at preventing severe disease. However, there were variations in efficacy in regional clinical trials when evaluated for moderate to severe COVID-19 with a 72% effectiveness in the United States, 57% in South Africa and 66% in Latin America reported. The vaccine also exhibited good results when multiple variants of COVID-19, such as B.1.351 variant found in South Africa were tested.

Johnson and Johnson [27] reported that the onset of protection was also observed as early as the 14th day of infection. The Janssen COVID-19 vaccine provided complete protection against COVID-related hospitalisation and death 28 days after vaccination. The vaccine was reported to have a clear effect on the number of COVID-19 cases requiring extracorporeal membrane oxygenation (ECMO), mechanical ventilation, or other medical interventions.

6.2 Gamaleya

The Sputnik V vaccine developed by Gamaleya is based on a human adenoviral vector platform and makes use of adenovirus 26 (Ad26) and 5 (Ad5) as vectors to express the genetic sequence of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) spike protein [28]. Logunov et al. [28] reported the interim results from a phase 3 clinical trial of the Sputnik V COVID-19 vaccine and the results revealed that the vaccine provided strong protection in all age groups that participated [29]. The efficacy of the vaccine established by monitoring confirmed cases of COVID-19 from 21 days after vaccine administration revealed 91.6% efficacy (95% CI 85•6–95•2) [29] and was equally effective in individuals in all age groups.

6.3 Sinopharm

Sinopharm, a pharmaceutical company based in the Republic of China, have developed an inactivated SARS CoV-2 vaccine, which has been administered to approximately 1 million individuals [30]. Additional phase 3 trials of the vaccine are currently being undertaken in Indonesia and Turkey [30]. In Brazil, the vaccine has been administered intramuscularly to participants in two different doses provided at an interval of 14 days [30]. The Sinopharm vaccine has been reported to be 79% effective [31] however, efficacy trials on the same product have p

roduced efficacy data of 50%, 65%, 78% and 91% [32].

7.Ethical Considerations Surrounding Vaccine Development and Production

A concerted application of science and technology is required to ensure that the research undertaken in respect of the COVID-19 outbreak includes risk assessment, management, vaccine development, and production whilst always promoting human rights. The development and production of an effective vaccine for dealing with the pandemic is y dependent on the outcomes of appropriately designed clinical and non-clinical trial outcomes performed in vitro, in animal and human subjects [33]. For this reason, there is a bioethical debate surrounding the trials conducted in respect of these vaccines developed during the pandemic. In respect of the COVID-19 situation, no vaccine has been proven to be effective for treatment of the disease and therefore an ethical dilemma when including healthy subjects for testing the efficacy of the vaccine exists [34]. The development and production of vaccines during pandemics is always likely to raise ethical concerns.

8. Challenges of Acquisition and Distribution of SARS-CoV-2 Vaccine in Middle- and Low-Income Developing Nations.

The rapid spread of the contagion crosses the globe and within less developed countries in Asia and Africa has resulted in a significant global health emergency. Countries require context-specific responses dependent on the prevailing situation such as number of COVID-19 cases ranging from none to a limited number or increased number of cases [32]. Decisive actions are required and effective physical (social) distancing, use of quarantine and/or lockdowns, implementation of widespread testing, contact tracing in a systematic manner are necessary to reduce the risk of further spread of the disease [32]. In combination with extensive testing the distribution of vaccines in low income developing counties is a significant challenge due to conflict, over population in rural and urban areas, and lack of accessibility to basic health services [30]. In developing countries, the most significant challenge includes the need for systematic decontamination measures and massive testing to reduce the risk of a devastating outbreak. The acquisition of COVID-19 vaccines requires an in-depth analysis of the changing epidemiology of the disease including the period of incubation between appearance and duration of symptoms [35].

The distribution of a vaccine is currently determined by considering an ability to develop and initiate testing and purchase vaccines [35]. A small number of multinational companies produce most of the vaccines globally and are also involved in negotiating with the private and public[36] sectors to sell their vaccines. In this respect developed countries of the

world attempt to purchase access to vaccine candidates well in advance whereas due to a lack of resources, developing countries are unlikely to have early access the vaccines [35]. Consequently there is likely to be inequitable access and an unethical allocation of vaccines, depending on the ability of countries to pay for vaccines and distributive justice is one of the fundamental considerations necessary when distributing vaccines during such a pandemic so as to ensure that the principles of distributive justice are met and the allocation of scarce resources are applied equally to all viz., local, national and global communities [35]. However, the limited supply of vaccines and the mass demand during pandemic situations is a challenge when aspiring to equal distribution of resources.

The lack of accessibility to vaccines and storage conditions required may result in failure to achieve desired clinical outcomes even if bulk distribution of vaccines to developing countries was successful [31]. The inadequate refrigerated cold chain network in many developing countries therefore poses a significant challenge. Consequently vaccine candidates for COVID-19 requires that require long term storage at -20 °C to -70°C are likely to result in the loss of vaccine particularly if inadequate refrigerated cold chain networks exist [32]. Therefore, the acquisition, distribution and successful clinical application of SARS-CoV-2 vaccine in low- and middle-income developing nations may be extremely challenging.

9. Conclusions

In light of the analysis and review of the vaccines that have been developed and approved for emergency use in many countries it is evident that grey areas exist and scientists are yet to establish conclusive solutions to ensure successful treatment strategies. Similar concerns are shared by the World Health Organization (WHO) in that assurance of long-term immunity or estimated time of immunity protection with the current vaccines are not yet known. In addition, there is no certainty of immune response or durability thereof. Evidence from the clinical trial data has revealed that the current vaccines have a e capability to protect some individuals against disease but are not conclusive in respect of an ability to prevent transmission and subsequent infection following exposure to the COVID-19 virus.

Furthermore, there is a dearth of evidence regarding the age-related use of these vaccines as, by way of example, the use of the vaccine in paediatric subjects has not yet been undertaken and efficacy established and as such these populations remain at risk to transmission and infection by the virus.

An additional concern relates to the availability of the sufficient vaccine doses to cater for entire communities and/or populations so as to ensure protection to a significant number and wide range of individuals, which may reduce confidence in the current intervention strategy and fight against COVID-19.

Consequently, it is recommended that adherence to COVID-19 protocols such as hand sanitization, physical distancing and wearing of masks is maintained despite the state of vaccination of an individual or population as the COVID-19 pandemic

REFERENCES

Randolph, H.E.; Barreiro, L.B. Herd Immunity: Understanding COVID-19. Immunity 2020, 52, 737–741, doi:10.1016/j.immuni.2020.04.012.

2. Jung, F.; Krieger, V.; Hufert, F.T.; Küpper, J.H. Herd immunity or suppression strategy to combat COVID-19. Clin. Hemorheol. Microcirc. 2020, 75, 13–17, doi:10.3233/CH-209006.

3. Netea, M.G.; Joosten, L.A.B.; Latz, E.; Mills, K.H.G.; Natoli, G.; Stunnenberg, H.G.; O'Neill, L.A.J.; Xavier, R.J. Trained immunity: A program of innate immune memory in health and disease. Science (80-.). 2016, 352, 427, doi:10.1126/-science.aaf1098.

4. Grifoni, A.; Weiskopf, D.; Ramirez, S.I.; Mateus, J.; Dan, J.M.; Moderbacher, C.R.; Rawlings, S.A.; Sutherland, A.; Premkumar, L.; Jadi, R.S.; et al. Targets of T Cell Responses to SARS-CoV-2 Coronavirus in Humans with COVID-19 Disease and Unexposed Individuals. Cell 2020, 181, 1489-1501.e15, doi:10.1016/j.-cell.2020.05.015.

5. Johnson, Z.I.; Zinser, E.R.; Coe, A.; McNulty, N.P.; Woodward, E.M.S.; Chisholm, S.W. Niche partitioning among Prochlorococcus ecotypes along ocean-scale environmental gradients. Science (80-.). 2006, 311, 1737–1740, doi:10.1126/science.1118052.

6. Mellet, J.; Pepper, M.S. A covid-19 vaccine: Big strides come with big challenges. Vaccines 2021, 9, 1–14, doi:10.3390/vac-cines9010039.

7. Anderson, E.J.; Rouphael, N.G.; Widge, A.T.; Jackson, L.A.; Roberts, P.C.; Makhene, M.; Chappell, J.D.; Denison, M.R.; Stevens, L.J.; Pruijssers, A.J.; et al. Safety and Immunogenicity of SARS-CoV-2 mRNA-1273 Vaccine in Older Adults. N. Engl. J. Med. 2020, 383, 2427–2438, doi:10.1056/nej-moa2028436.

8. Dong, Y.; Dai, T.; Wei, Y.; Zhang, L.; Zheng, M.; Zhou, F. A systematic review of SARS-CoV-2 vaccine candidates. Signal Transduct. Target. Ther. 2020, 5, doi:10.1038/s41392-020-00352-y.

9. Polack, F.P.; Thomas, S.J.; Kitchin, N.; Absalon, J.; Gurtman, A.; Lockhart, S.; Perez, J.L.; Pérez Marc, G.; Moreira, E.D.; Zerbini, C.; et al. Safety and Efficacy of the BNT162b2 mRNA Covid-19 Vaccine. N. Engl. J. Med. 2020, 383, 2603–2615, doi:10.1056/nejmoa2034577.

10. Biorender Immunogenecity to SARS-CoV-2 2021.

11. Han, S. Clinical vaccine development. Clin. Exp. Vaccine Res. 2015, 4, 46, doi:10.7774/cevr.2015.4.1.46.

12. Singh, K.; Mehta, S. The clinical development process for a novel preventive vaccine: An overview. J. Postgrad. Med. 2016, 62, 4–11, doi:10.4103/0022-3859.173187.

13. Corbett, K.S.; Edwards, D.K.; Leist, S.R.; Abiona, O.M.; Boyoglu-Barnum, S.; Gillespie, R.A.; Himansu, S.; Schäfer, A.; Ziwawo, C.T.; DiPiazza, A.T.; et al. SARS-CoV-2 mRNA vaccine design enabled by prototype pathogen preparedness. Nature 2020, 586, 567–571, doi:10.1038/s41586-020-2622-0.

14. Vabret, N. Antibody responses to SARS-CoV-2 short-lived. Nat. Rev. Immunol. 2020, 20, 519, doi:10.1038/s41577-020-0405-3.

15. Sharma, O.; Sultan, A.A.; Ding, H.; Triggle, C.R. A Review of the Progress and Challenges of Developing a Vaccine for COVID-19. Front. Immunol. 2020, 11, doi:10.3389/fimmu.2020.585354.

16. Conforti, A.; Marra, E.; Roscilli, G.; Palombo, F.; Ciliberto, G.; Aurisicchio, L. Are Genetic Vaccines the Right Weapon against COVID-19? Mol. Ther. 2020, 28, 1555–1556, doi:10.1016/j.ymthe.2020.06.007.

17. Sharpe, H.R.; Gilbride, C.; Allen, E.; Belij-Rammerstorfer, S.; Bissett, C.; Ewer, K.; Lambe, T. The early landscape of coronavirus disease 2019 vaccine development in the UK and rest of the world. Immunology 2020, 160, 223–232, doi:10.1111/imm.13222.

18. Triggle, C.R.; Bansal, D.; Farag, E.A.B.A.; Ding, H.; Sultan, A.A. COVID-19: Learning from Lessons To Guide Treatment and Prevention Interventions. mSphere 2020, 5, doi:10.1128/msphere.00317-20.

19. Mulligan, M.J.; Lyke, K.E.; Kitchin, N.; Absalon, J.; Gurtman, A.; Lockhart, S.; Neuzil, K.; Raabe, V.; Bailey, R.; Swanson, K.A.; et al. Phase I/II study of COVID-19 RNA vaccine BNT162b1 in adults. Nature 2020, 586, 589–593, doi:10.1038/s41586-020-2639-4.

20. Graham, S.P.; McLean, R.K.; Spencer, A.J.; Belij-Rammerstorfer, S.; Wright, D.; Ulaszewska, M.; Edwards, J.C.; Hayes, J.W.P.; Martini, V.; Thakur, N.; et al. Evaluation of the immunogenicity of prime-boost vaccination with the replication-deficient viral vectored COVID-19 vaccine candidate ChAdOx1 nCoV-19. bioRxiv 2020, doi:10.1101/2020.06.20.159715.

21. Folegatti, P.M.; Ewer, K.J.; Aley, P.K.; Angus, B.; Becker, S.; Belij-Rammerstorfer, S.; Bellamy, D.; Bibi, S.; Bittaye, M.; Clutterbuck, E.A.; et al. Safety and immunogenicity of the ChAdOx1 nCoV-19 vaccine against SARS-CoV-2: a preliminary report of a phase 1/2, single-blind, randomised controlled trial. Lancet 2020, 396, 467–478, doi:10.1016/S0140-6736(20)31604-4.

22. Tebas, P.; Yang, S.P.; Boyer, J.D.; Reuschel, E.L.; Patel, A.; Christensen-Quick, A.; Andrade, V.M.; Morrow, M.P.; Kraynyak, K.;

THE EFFECTS OF MATERNAL SMOKING ON INFANT DEVELOPMENT: A SYSTEMATIC REVIEW

Author: Malebogo Ramothwa

1. Department for Medical Laboratory Science, DDT College of Medicine.

2. Department of Medicine, DDT College of Medicine.

DDT College of Medicine,
P.O. Box 70587, Gaborone Botswana
Tel: +267(0)3904924/5
Cell: +267(0) 7710000
Fax: +267(0)3904935

Corresponding Author *Dr Derrick D .Tlhoiwe, Dr Tumelo Tlhoiwe, Larry.L. Mweetwa*
Email: *journals@ddtcollegeofmedicine.com*

Abstract|

Maternal smoking is a prime health care concern and by definition, refers to smoking before, during and or after gestation. The rationale for this systematic review is to evaluate and highlight the effects of maternal smoking on infants.
The study attempt to investigate the effect of maternal smoking on an infant's development. In addition, the study considered mothers who smoked before pregnancy, mothers who smoked or where exposed to smoked tobacco containing substance during pregnancy and mothers who smoked or where exposed to tobacco containing substance after delivery (during the period of nursing their babies from 0year old up to 2 years old).

Key words| , Smoking, Pregnancy, Infant

Background

It is documented that more than 1 billion people use smoke products worldwide and it is estimated that this significant number will reach 1.9 billion by 2025 (Guindon G Emmanuel et., al 2003) .According to the World Health Organization (WHO), there are approximately 6 million deaths per year caused by tobacco, and the economic burden of increased tobacco-related morbidity and mortality runs in the hundreds of billions of dollars (WHO Report on the Global Tobacco Epidemic 2011). Many smokers, however, remain unaware of the harmful consequences of their tobacco use for themselves, their families, as well as for the larger public. Many others, although knowing about these consequences to themselves and others, still have profound difficulty in quitting because of the addictive nature of nicotine (WHO Report on the Global Tobacco Epidemic 2011). Prenatally, this occurs through maternal smoking or maternal second hand smoke (SHS) exposure.

Maternal smoking is a prime health concern meaning to smoke before, during and after gestation (Little, R.E., 1977).

Early life exposure to tobacco smoke products has been linked to causing adversely effect on maternal health childhood (Young, S., et al 1991). Some of the key manifestations that come about due to maternal smoking are increased airways responsiveness which was found among young infants born smoking mothers was diminished in babies of mothers who smoked during pregnancy, compared to babies of mothers who did not [Hanrahan JP., et al 1992].

Also an increased risk of asthma was reported at 8–11 yrs of age in children exposed to maternal smoking only whilst in utero compared to non-exposed children (Cunningham J, et al 1996).

Other researchers have debated that in-utero exposure to the products of cigarette leads to reduced respiratory function in young infants (Hanrahan, J.P., et al 1992). Environmental tobacco smoke causes wheezing, and asthma in children in 24 communities Thus, early exposure to tobacco smoke appears to be a risk factor for reduced lung function as well as obstructive airways disease (OAD). Implications of reduced lung function soon after birth are not well established. Premorbid flow limitation has been reported during the first months of life among children who subsequently wheezed by 2 years of age (Young, S., et al 1991).

Epidemiological data of research topic

There is increase use of smokeless tobacco by women in Africa and Asia and are seldom advised to stop during pregnancy (Changrani, J., et al 2005). These women are exposed to nicotine and often not to the combustion products in tobacco smoke which include carbon monoxide and cyanide and may result to fetal hypoxia and decrease in birth weight (Russo, E.B., 2014). It is found out that 10.7% of women aged 15 years and above smoked regularly, but only 5.3% of black women were discovered to do so. However, black women predominated the use of smokeless tobacco (Steyn, K., et al 1998).

Statement of the problem

Smoking during pregnancy increases the risk of health problems for developing babies, including preterm birth, low birth weight, and birth defects of the mouth and lip. Smoking during and after pregnancy also increases the risk of sudden infant death syndrome (SIDS). Smoking has been reported to affect fetal motor behavior, as shown by a reduction of fetal movements (Kelly., et al 1984). During childhood, several studies have revealed a statistical relationship between behavioral abnormalities and smoking in pregnancy (Davie., et al 1972). In Botswana there exist no data researched on effects of maternal smoking on infant‘s development addressing this topic, however the phenomenal is prevalent.

Rationale

Mortality and morbidity owing to effects of maternal smoking is one of the leading health problems in the world today (World Health Organization, 2014). Therefore, planning and implementation of effective preventative strategies to combat the effects of maternal smoking on infant‘s development is cardinal but to change policy and direction by Ministry of health in Botswana there is need to have authentic data and detailed information on the profiles of injury. As stated in statement of the problem above, the problem has not been holistically considered comprehensively in Botswana. Grounded on the above evidence, this study, therefore is of utmost importance as it seeks to uncover the profiles of effects of maternal smoking on infant‘s development.

Research Aims

The aim of this study is to evaluate impact of maternal smoking on infant development.

General objective

To determine the effects of prenatal, antenatal and postnatal exposure to smoking on infants development.

Specific objectives

1. To determine the burden maternal smoking has on infants in pack years.
2. To determine the infants ‘developmental changes born by women exposed to smoking and or smoked during pregnancy from birth to through 2 years of age.

METHODOLOGY

In addressing the aims and objectives of the research topic, secondary data was systematically reviewed. The databases used for collecting the data included PubMed, Google scholar and NCBI. The utilization of the multiple databases presented the opportunity to gain accurate, pertinent, and reliable information that signified the primary aspects of the study. Also, the research study used the PRISMA tool for screening the research resources.

RESULTS

Identified studies were studied, different research articles and journals from reliable and credible sources like PUBMED to explore impact of global healthcare cost, to evaluate key drivers of Global health care cost and to evaluate how global health care cost impact developing nations. PRISMA flow diagram was used for analysis. The paper is purely literature based, no external ethical committee needed to review the paper. In the final compilation of data, 13 articles were reviewed.

Fig 1.0 | Prisma Flow Chart

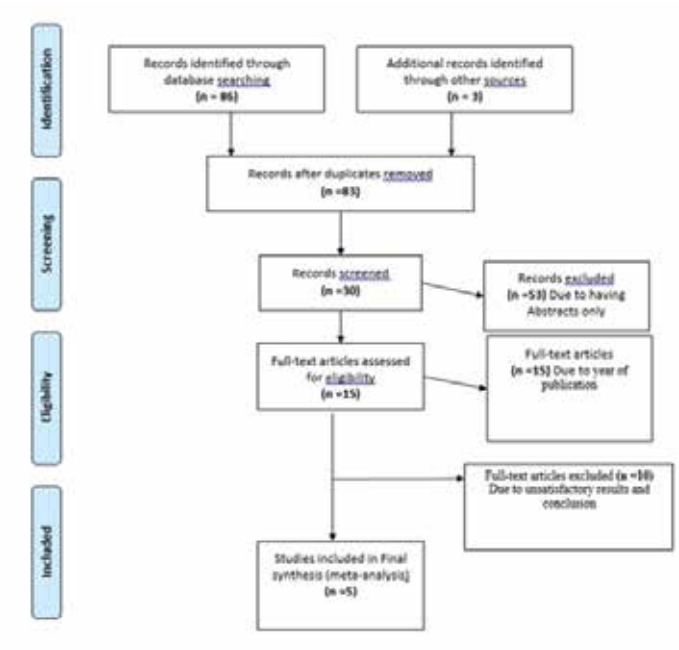
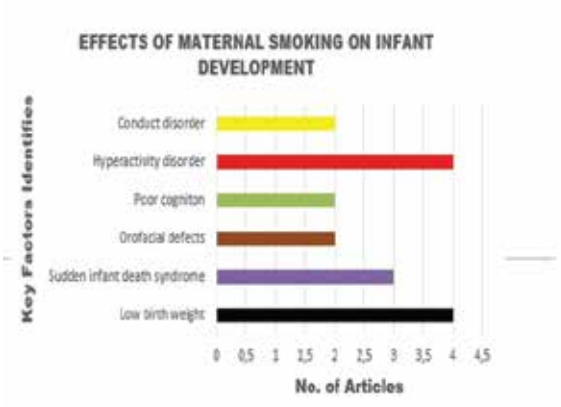


Fig 1.2| KEY RESULTS AND DISCUSSION



DATA ANALYSIS AND INTERPRETATION

Alteration in the thyroid function and iodine deficiency

(Peter Laurberg et.,al 2004)explained effects of maternal smoking on thyroid function to be caused by increase in thiocyanate on the thyroid gland which inhibits iodine transportation, increases iodine influx and reduces iodination of the molecule that binds to T3. In another study A .Gasparoni et.,al 1998 stated that passage of nicotine metabolites through the placenta causes increased concentrations of thyroid gland and thiocyanate leading to thyroid enlargement in new-borns and disturbed development of the offspring. Thiocyanate from tobacco smoking impairs iodine transportation from breastfeeding mother to infants which puts infants at high risk of iodine deficiency

Increased risk of infant allergy

According to Carl .G.M Magnusson 1986, maternal smokers has an increased level of IgE and IgD and also passive smoking triggers IgE synthesis in exposed infants. An increase in cord IgM, IgA, IgE and IgD was found in infants born to smoking mothers putting the infants at fourfold great risk of developing definite or probable allergy before 18 months of age. Substance in tobacco smoke affect fetal immunoglobulin synthesis ,and by turning on the IgE system already in utero ,predisposes the new-born infant to subsequent sensitization .The closer intimacy with a smoking mother will later on cause development of allergic symptoms on the infant .

Arousal patterns in sleeping infants 26

There is an altered arousal process to somatosensory stimulation in infants exposed to maternal smoking. Infants born to smoking mothers display decreased cortical arousal proportions and increased sub cortical activations proportions compared to non-exposed infants .Maternal smoking alters progression from sub cortical activations to cortical arousal predisposing exposed infants to sudden infant death syndrome .This was explained by Richardson et al 2009 in a study in which he wanted to find out how maternal smoking affects sleep arousal .Hemant Sawnani et al 2004 outlined in his study that succeeding studies showed that maternal smoking leads to impairment of both stimulus-induced arousal and spontaneous arousal from sleep.

Risk of childhood obesity

In another study E. Oken e
t al 2008 stated in his research that single studies have showed that infants exposed to prenatal smoking may have greater weight gain from birth to 2 years of age and exhibit high risk of low birth weight and higher attained BMI as they grow .Prenatal exposure to maternal cigarette smoking may promote obesity by enhancing dietary preference for fat through neural mechanism involved in the amygdala. According to L.Li et al 2015, fetal exposure to nicotine may affect the in utero development of the hypothalamic function, employing an impact of appetite control and energy expenditure throughout the life course. 27

Low birth weight

A study by Guyer B et al 1999 showed a 7.6% incidence of infants born with a low birth weight was recorded of all live born infant s and 65% of deaths occur among this infants with low birth weight in United States. Andres RL et al 2000 says smoking during pregnancy doubles the risk of lower birth weight in exposed infants, it accounts for about 20% to 30% of lower birth weight. However non-exposed infants weigh higher than exposed infants. 28

Cognitive and behavioral disorders

Wakschlag, L.S et al 1997 found conduct disorder to precisely be associated with maternal smoking in a study that surveyed the relationship between conduct disorder and maternal smoking. Furthermore, Brook, J.S., et al 2000 stated that numerous studies have also shown that maternal smoking during pregnancy

is related to cognitive, emotional, temperamental and behavioural problems throughout the life of the child. The problems most closely related to maternal smoking during pregnancy are negativity. 29

Respiratory disorders

Indicated by Colley , J.R.T ., et al 1974, infants exposed to inactive smoking in their early life has a higher risk of developing lower respiratory infections .Prenatal moking increases chances of symptomatic asthma in paediatric according to Von Mutius , E ., 2002 . Adding to his findings, Von Mutius, E., 2002 stated that the long term prognosis of early wheezing illness was better if the mother smoked. The excess incidence of wheezing in smoking households appears to be largely non-atopic __wheezy bronchitis‘‘, which has a relatively benign prognosis. Therefore, postnatal environmental tobacco smoke exposure can be reflected as a co-factor aggravating wheezing attacks, rather than a cause of the underlying asthmatic tendency. Fletcher, M.E., et al 1999 outlined that the reason why prenatal passive smoking is associated with paediatric asthma, and postnatal passive smoking is associated with non-atopic __wheezy bronchitis‘‘, remains to be explained. Possibly, a reduction in lung function as a result of prenatal passive smoking makes the children more susceptible for respiratory symptoms, and therefore enables the diagnosis of paediatric asthma. Furthermore, according to Redd, S.C., et al 2002 the distinction between wheezy bronchitis and asthma can be very difficult, and it seems conceivable that they can co-exist as well. Among children with established asthma, parental smoking is associated with more severe disease.
Lahey, B.B., et al 1999 concluded that infants born to smoking mothers lung function tests show a reduction in forced expiratory flows compared to infants born to non-smoking mothers. Another study by Von Mutius, E., 2002 detailed that prenatal maternal smoking increases the risk for symptomatic pediatric asthma. 30

Sudden infant death syndrome

Byard, R.W. and Krous, H.F., 2003 explained sudden infant death syndrome (SIDS) as the sudden death of an infant aged younger than 1year that remains unexplained after a thorough case investigation that includes an autopsy, a death scene investigation, and a review of the clinical history of the parents and the infant . Supporting this Shah,Sullivan, K. and Carter, J., 2006 defined that known risk factors for SIDS include sleeping in the prone position, being exposed to smoke pre- and postnatal, sharing a bed with a mother who smokes, hyperthermia, lack of breastfeeding, and sleeping on soft surfaces .As shown by Anderson, H.R. and Cook, D.G., 1997 prenatal exposure to smoking likely means exposure to smoking during pregnancy and after pregnancy as well a systematic review concluded that after adjusting for confounders, such as sleeping position and economic status, maternal smoking doubles the risk for SIDS .

Middle ear disease

Published case control studies from Canada, Sweden Malaysia and Minnesota, USA by Derek G Cook et., al 1999 showed the relationship between parenteral smoking and middle ear disease (acute and chronic otitis media) on the exposed offspring.

CONCLUSION

In the final analyses of effects of maternal smoking on infant‘s development, the study depicts that maternal smoking has a negative impact on infant‘s development. It affects the thyroid function of the exposed infant and puts the infant at a risk of iodine deficiency .Exposure to smoking by the infant increases the infant‘s immunoglobulin‘s, making the infant more sensitive and prone to allergy diseases. It increases the risk of childhood obesity in exposed infants putting them at risk of cardiovascular diseases .Children born to smoking mothers has a 50% increased risk of later overweight compared with children whose mothers did not smoke during pregnancy.
This findings add to the recognised health burden, from tobacco already estimated at almost 5 million deaths per year. Maternal smoking inclines the exposed infants to respiratory disorders such as asthma and it is estimated that elimination of in utero maternal smoking would prevent 5 to 15% of asthma cases in children. Maternal smoking causes low birth weight, sudden infant death syndrome, middle ear diseases, cognitive and behavioral disorders like conduct and anti-social disorders. Prenatal smoking is associated with a 20-30% higher likelihood for stillbirth, a 40% elevation in the risk for infant mortality and a 2-fold increase in the incidence of SIDS.
Maternal smoking in general it depreciates the infants ‘development and welfare. Both maternal smoking and passive smoking by the infant has been proven in many researches to negatively affect infant‘s development. The side effects of maternal smoking in infants development are not only limited to infancy stage but may also persist into childhood and adulthood. 33

LIMITATIONS

One of the limitations encountered in this study was that there were no any local researches done on effects of maternal smoking on infant‘s development and so the research had to focus on reviewing international articles as there were also not much of this topic specific studies done in Africa.

Recommendation

To tackle this issue and prevent infants being affected by maternal smoking community education should be provided on how maternal smoking affects infants and more local researches should be carried out to determine the relationship between infant‘s development and maternal smoking taking into consideration the duration, amount or degree of smoking and the different types of smoke products.

The findings highlight that deal with infant's development should not only focus on policies targeting eating behaviors and physical activity of the infant but also on early interventions of behaviors of pregnant woman. Studies which allow comparison of the effects of critical periods of exposure to ciggarate smoke particularly in utero, early infancy and later childhood.

REFERENCES

REFERENCES

Button, T.M.M., Maughan, B. and McGuffin, P., 2007. The relationship of maternal smoking to psychological problems in the offspring. Early human development, 83(11), pp.727-732.

Byard, R.W. and Krous, H.F., 2003. Sudden infant death syndrome: overview and update. Pediatric and developmental pathology, 6(2), pp.112-127.

Changrani, J. and Gany, F., 2005. Paan and gutka in the United States: an emerging threat. Journal of Immigrant Health, 7(2), pp.103-108.

Cook, D.G., Strachan, D.P. and Carey, I.M., 1998. Health effects of passive smoking. 9. Parental smoking and spirometric indices in children

Garrett, B.E., Dube, S.R., Trosclair, A., Caraballo, R.S., Pechacek, T.F. and Centers for Disease Control and Prevention (CDC), 2011. Cigarette smoking—united states, 1965–2008. MMWR Surveill Summ, 60(1), pp.109-113.

Fowler, J.A., Maurer, K.R., Davis, W.W. and Overpeck, M.D., 1998. The bu

Hanrahan, J.P., Tager, I.B., Segal, M.R., Tosteson, T.D., Castile, R.G., Van Vunakis, H., Weiss, S.T. and Speizer, F.E., 1992. The effect of maternal smoking during pregnancy on early infant lung function. American Review of Respiratory Disease, 145(5), pp.1129-1135.

Lahey, B.B., Waldman, I.D. and McBurnett, K., 1999. Annotation: The development of antisocial behavior: An integrative causal model. The Journal of Child Psychology and Psychiatry and Allied Disciplines, 40(5), pp.669-682.

McMartin, K.I., Platt, M.S., Hackman, R., Klein, J., Smialek, J.E., Vigorito, R. and Koren, G., 2002. Lung tissue concentrations of nicotine in sudden infant death syndrome (SIDS). The Journal of pediatrics, 140(2), pp.205-209.

Mitchell, E.A. and Milerad, J., 2006. Smoking and the sudden infant death syndrome. Reviews on environmental health, 21(2), pp.81-104.

Stein, C.E., Kumaran, K., Fall, C.H., Shaheen, S.O., Osmond, C. and Barker, D.J., 1997. Relation of fetal growth to adult lung function in south India. Thorax, 52(10), p.895.

Steyn, K., Bradshaw, D., Norman, R., Laubscher, R. and Saloojee, Y., 2002. Tobacco use in South Africans during 1998: the first demographic and health survey. Journal of cardiovascular risk, 9(3), pp.161-170.

Stroud, L.R., Paster, R.L., Papandonatos, G.D., Niaura, R., Salisbury, A.L., Battle, C., Lagasse, L.L. and Lester, B., 2009. Maternal smoking during pregnancy and newborn neurobehavior: effects at 10 to 27 days. The Journal of pediatrics, 154(1), pp.10-16.

Tager, I.B., Hanrahan, J.P., Tosteson, T.D., Castile, R.G., Brown, R.W., Weiss, S.T. and Speizer, F.E., 1993. Lung function, pre-and post-natal smoke exposure, and wheezing in the first year of life. American Journal of Respiratory and Critical Care Medicine, 147(4), pp.811-817

Von Mutius, E., 2002. Environmental factors influencing the development and progression of paediatric asthma. Journal of allergy and clinical immunology, 109(6), pp.S525-S532

EFFECTS OF MATERNAL SMOKING ON INFANT DEVELOPMENT

Author: : Samuel Kelekgethetse

1. Department for Medical Laboratory Science, DDT College of Medicine.

2. Department of Medicine, DDT College of Medicine.

Corresponding Author Dr Derrick D. Tlhoiwe, Dr T Tlhoiwe, *Larry.L. Mweetwa*
Email: *journals@ddtcollegeofmedicine.com*

DDT College of Medicine,
P.O. Box 70587, Gaborone Botswana
Tel: +267(0)3904924/5
Cell: +267(0) 7710000
Fax: +267(0)3904935

Abstract|

The study attempt to investigate the effects of maternal smoking on an infant's development. In addition, the study considered mothers who smoked before pregnancy, mothers who smoked or where exposed to smoked tobacco containing substance during pregnancy and mothers who smoked or where exposed to tobacco containing substance after delivery (during the period of nursing their babies from 0year old up to 2 years old).
Maternal smoking is a prime health care concern and by definition, refers to smoking before, during and or after gestation. The rationale for this systematic review is to evaluate and highlight the effects of maternal smoking on infants. This systematic review is going to be done using research papers and publications that underline the side effects of maternal smoking on infant's development. The review is literature based therefore participation and approval from ethic committee will not be required.

Key words| Maternal, Smoking

Background

It is recorded that more than 1 billion people use smoke products worldwide and it is anticipated that this significant number will reach 1.9 billion by 2025 (Guindon, G.E., et al 2003). According to the World Health Organization (WHO), there are approximately 6 million deaths per year as a result of tobacco use. And the economic burden of increased tobacco-related morbidity and mortality runs in the hundreds of billions of dollars (World Health Organization, 2017). Therefore, it is a great concern to the nation and the future generation.

Many smokers, however, remain unaware of the harmful consequences of their tobacco use for themselves, their families, as well as for the larger public. Though many others knowing about these consequences to themselves and community, still have profound difficulty in quitting because of the addictive nature of nicotine (World Health Organization, 2017).

According to Centers for Disease Control and Prevention (CDC) tobacco leaves are used in making both cigarettes and cigars, a substance that contain a known drug nicotine, which is a very addictive substance and smokers easily become addicted to smoking due to the addictive nature of nicotine. Addiction in this context is the state of the brain in which an individual compulsively smoke despite its harmful consequences. According to Centers for Disease Control and Prevention, tobacco emanates smoke which contains over 7000 chemicals, of which 250 of these chemicals are harmful to both smokers and none smokers

(passive smokers). Sixty nine of these can cause cancer ad as well can induce severe harm to nearly every organ in the body which includes: heart disease, lung disease, eye problem, damage of the central nervous system, and cancer. There currently exist several types of smoking according to the center of disease control and prevention: Cigarettes, Cigars, pipe and e-cigarettes (electronic cigarettes). Electronic cigarettes look like pens, memory sticks, or asthma inhalers and contain liquid that include nicotine, flavours of cinnamon, strawberry or bubble gum and other chemicals. They differ from cigars and cigarettes in that the e-cigarettes use batteries.

Smoking can occur in various forms or stages, this include the primary smoker, second hand smoker, and third hand smoker. The second hand smokers are those who breathe in the cigarettes or other tobacco substance smoke by being around the primary smoker. The third hand smoke is the left-over smoke on the smoker's clothes, house furniture's, carpets, hair. According to CDC third hand smoke contains 250 chemicals and is very harmful to the pregnant women, babies/infants and children and may cause severe health problems.

Maternal smoking is a prime health concern and relates to women who incline to smoke before, during, and or after gestation of a child (Little, R.E., 1977)

Early life exposure to tobacco smoke products has been linked to causing adversely effect on maternal health childhood (Young, S., et al 1991). A diminish in airway responsive was noted in infant born to smoking mothers against none smoking mothers. (Hanrahan, J.P., et al 1992). Children between the ages 8–11 years old, who were exposed to maternal smoking in utero, had an increased risk of developing asthma when compared to non-exposed children (Cunningham J, et al 1996). Other researchers have debated that in-utero exposure to the products of cigarette leads to reduced respiratory function in young infants (Hanrahan, J.P., et al 1992). Environmental tobacco smoke causes wheezing, and asthma in children in 24 communities thus, early exposure to tobacco smoke appears to be a risk factor for reduced lung function as well as obstructive airways disease (OAD) (Cunningham, J., et al 1996). Implications of reduced lung function soon after birth are not well established. Premorbid flow limitation has been reported during the first months of life among children who subsequently wheezed by 2 years of age (Young, S., et al 1991)

RESEARCH AIM

The aim of this study is to conduct a systematic review on the effects of maternal smoking on infant development.

OBJECTIVE

1. To identify the effects of tobacco smoking on infants development.
2. To identify the effects maternal smoking has on infants in pack years

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METHODOLOGY

In order to answer the aims and objectives of the research topic, secondary data was systematically reviewed. The databases used for attaining the information included PubMed, Google scholar. The utilization of the multiple databases presented the opportunity to gain accurate and reliable information that signified the primary aspects of the study. Also, the research study used the PRISMA tool for screening the research resources.

RESULTS

Identified studies were uploaded into endnote (Thomas Reuters) and duplicates were removed. 3 reviewers vetted through the study based on the topic and abstracts that met the inclusion criteria. Studies selected after the first screening were further screened through a detailed full text browsing, to further exclude studies that had some of the exclusion criteria. Out of 83 studies identified, 53 were excluded due to having abstracts only.. Out of the 30 selected, 15 were further excluded due to year of publication. Out of 15 articles, 10 were further excluded due to unsatisfactory results and conclusion. Only 5 were finally used.

Fig 1.0 | Prisma Flow Chart

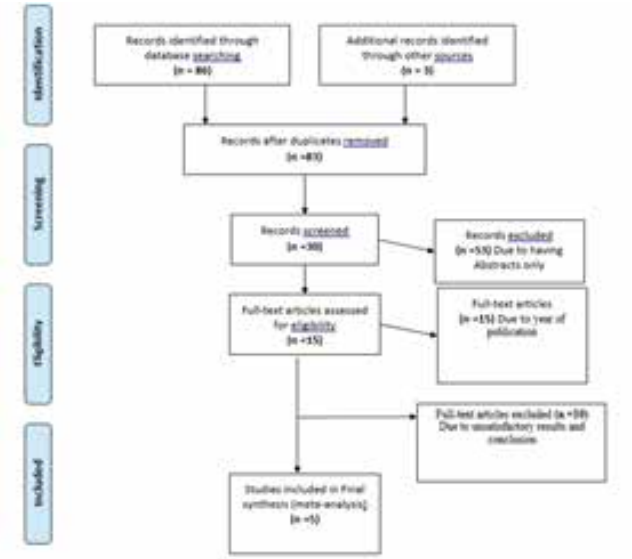
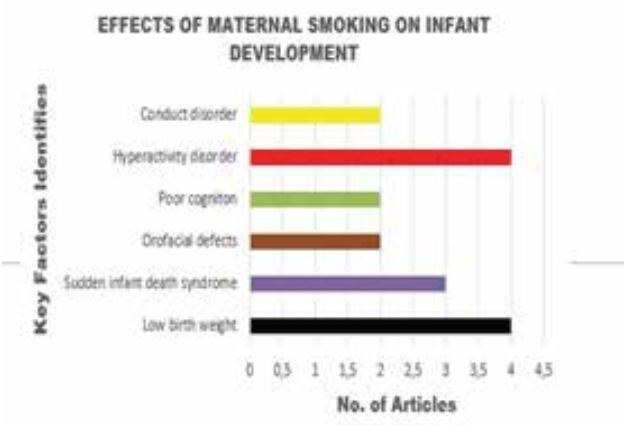


Fig 1.2| KEY RESULTS AND DISCUSSION



DATA ANALYSIS AND INTERPRETATION

1 Low birth weight

Low birth weight is a term used to depict babies who are brought into the world weighing less than 2,500 grams (Paneth, N.S., 1995).

Low birth weight may resullt following preterm delivery or intrauterine growth retardation. Use of smoke products during pregnancy is a major risk fctor for IUGR; the meta-analysis by (Kramer, M.S., 1987) indicated odd ratio of 2.42 for smokers. Maternal smoking could influence intrauterine development in at any rate three distinct ways. The primary system is fetal hypoxia inferable from expanded carboxyhaemoglobin levels, attenutated blood oxygen emptying to fetal tissues and decreased maternal blood to the placenta (Abel, E.L., 1980). Second, nicotine incites an expansion in maternal catecholamines with consequent uterine vasoconstriction (Quigley, M.E., 1979). Lastly, cyanide mixes in tobacco smoke may meddle with fetal oxidative digestion (Andrews, J., 1973).

Infants exposed to maternal smoking during pregnancy are at increased risk for low birth weight, show an average 200g decrease in continuous birth weight, and have two to four times high rates of sudden infant death syndrome, the foremost cause of death in the first year (Dietz, P.M., et al 2010). A reduction on weight by 10-15g is estimated to happen following maternal smoking per cigarette smoked daily. A study done by (Chiolero, A., Bovet, P. and Paccaud, F., 2005) linked maternal smoking during pregnancy with low birth weight, small for gestation age and preterm birth. Reducing or eliminating smoking during pregnancy has been shown to improve birth weight (Sexton, M., et al1984).

Pre-birth care is a key factor in forestalling preterm births and low birth weight babies. At pre-birth visits, the wellbeing of both mother and hatchling can be checked (Branson, B.M., 2006). Since maternal nourishment and weight put on are connected with foetal weight gain and birth weight, eating a sound eating routine and putting on the best possible measure of weight in pregnancy are basic. Moms ought to likewise keep away from liquor, cigarettes, and unlawful medications, which can add to poor foetal development, among different confusions (Wilkinson, R.G., et al 2003).

Sudden infant death syndrome

Abrupt newborn child demise disorder (SIDS) is the unexplained passing, for the most part during rest, of an apparently solid infant not exactly a year old (Guntheroth, W.G., 1989).

.The putative effect of smoking on sudden infant death syndrome may be facilitated through changes in the oxygen sensitivity of the peripheral arterial chemoreceptors, resulting to elevated susceptibility

In a prospective study done by (Wisborg, K., et al 2000), children exposed to maternal smoking during pregnancy had an elevated risk of sudden infant death syndrome compared to unexposed children to maternal smoking during pregnancy.

An expanded danger of SIDS when children are presented to tobacco smoke both during pregnancy and after birth has been found in various epidemiological, casecontrols and accomplice contemplates from around the globe (Zhang, K., et al 2013). A huge case-control study in the United Kingdom including families with infants conceived during the period 1993-1995, since the adjustment in dozing position was advanced, discovered that the occurrence of smoking during pregnancy was fundamentally more noteworthy in moms of 195 SIDS cases (63%) than in moms of 780 controls (25%) (Blair, P.S., et al 1996). This finding is reliable after some time and nation.

An ongoing meta-examination of 35 case-control concentrates announced a portion reaction relationship, implying that the more tobacco smoke the child is presented to, the higher the danger of unexpected baby demise (Zhang, K., et al 2013).

Oro-facial clefts

Congenital fissure and sense of taste are birth imperfections of the mouth and lip, otherwise called oral-facial clefts (Fraser, F.C., 1970). Congenital fissure is a variation from the norm where the lip does not totally shape during fetal improvement. The level of the congenital fissure can change incredibly, from gentle (scoring of the lip) to extreme (huge opening from the lip up through the nose), wherein case the separated can be truly recognizable (Neville, B.W., et al 2015).

Congenital fissure happens when the top of the mouth does not totally close during fetal advancement, leaving an opening that can reach out into the nasal pit (Walker, B.E., et al 1956). The parted may include either side of the palate. It can reach out from the front of the mouth (hard sense of taste) to the throat (delicate sense of taste). Frequently the split will likewise incorporate the lip. Cleft palate isn't as observable as cleft lip since it is inside the mouth (Rapp, R.S. et al 1968).

The relationship between maternal smoking and oro-facial clefts has been weighed in many studies, and a meta-analysis of these studies proposes a modest positive association for both cleft lip with or without cleft palate and cleft palate only (Little, J., et al 2004). Wyszynski, D.F., Duffy, D.L. and Beaty, T.H., 1997, found out there is significantly relationship between maternal smoking during the first trimester of pregnancy and the development of cleft lip with or without cleft palate and cleft with palate in their meta-analysis.

The imperfections result from no closure of explicit facial structures in week 5 through 9 of pregnancy, and require broad careful and corresponding treatment. For unexplained reasons, Norway has one of the most elevated recorded prevalence of these deformities, especially of congenital fissure (1.5 per 1000 births) (Harville, E.W., et al 2005)

Impaired cognition

Intellectual hindrance is the point at which an individual experiences difficulty recalling, adapting new things, thinking, or settling on choices that influence their regular daily existence (Halpern, D.F., 1998).

The hippocampus is a significant region of the cerebrum in charge of momentary memory and consecutive learning, just as a piece of the limbic framework which has been related with pathology in ADHD. The cerebellum assumes a job in the joining of tangible information and coordination of brain control (Halpern, D.F., 1998). Harm to these two territories of the cerebrum can change how an individual sees and reacts to their condition.

Such harm can likewise modify the creating tactile cortex, initiating changes in visual, somatosensory, and sound-related capacity (Metherate, R., 2004). Changes in the hippocampus are probably going to influence memory, conduct, brain and psychological capacity (Huang, L.Z., et al 2007). Because the hippocampus develops near the end of pregnancy and after birth in the first few years of life, harm happens with all environmental contacts including maternal smoking (Kuhn, C., et al 1993). Some exposed children have been shown to have an increased incidence of auditory-cognitive deficits that cause problems with understanding speech and verbally presented information, particularly in noisy settings. They might be not able tell contrasts between comparative sounds in spite of the fact that their hearing isn't disabled. Sound-related handling issues are most conspicuous in guys, while females show both sound-related and visual intellectual disabilities (Jacobsen, L.K., et al 2007)

In an investigation of new-born child insight, discourse preparing capacity was evaluated between eight pregnancy tobacco exposed and eight non-pregnancy tobacco exposed infants (Key, A.P., ET AL 2006). Utilizing occasion related possibilities, exposed infants separated less syllables and handled them more gradually than non-exposed infants. In this way, pregnancy tobacco introduction may prompt changes in cerebrum physiology that influence fundamental perceptual abilities (Cornelius, M.D., et al 2009). A prior audit of the writing takes note of a few examinations that show psychological deficiencies related with maternal smoking
(Fergusson, D.M., et al 1993). For example (Olds, D.L., et al 1994) discovered that smoking 10 or more

cigarettes per day during pregnancy was linked with a 4.35 point deduction in Stanford-Binet intelligence quotient scores of new-borns.

Hyperactivity Disorder

Attention-deficit/hyperactivity disorder (ADHD) is a brain disorder marked by an ongoing pattern of inattention and/or hyperactivity-impulsivity that interferes with functioning or development (Willcutt, E.G., 2005).

A few examinations have discovered that maternal smoking during pregnancy was a hazard factor for the advancement of ADHD in posterity (Kotimaa, A.J et al 2003).

One examination demonstrated that infants with 2 duplicates of a dopamine transporter quality polymorphism are bound to develop ADHD within the sight of maternal smoking (Becker, K., et al 2008). According to (Neuman, R.J., et al 2007) infants with the DAT1 440 allele, or DRD4 7-repeat allele, and pre-birth tobacco exposure were observed to be 1.8 and 2.1 occasions more probable, respectively, to be determined to have DSM-IV combined subtype ADHD. Infants with pre-birth tobacco smoke presentation in addition to one such allele were observed to be multiple times bound to have an ADHD determination, and youngsters with the two alleles in addition to maternal pre-birth smoke introduction were multiple times bound to have "population characterized" ADHD finding than infants with neither one of the risks factor (Neuman, R.J., et al 2007)

A planned, populace based investigation demonstrated maternal smoking to be freely connected with a 1.30 occasions expanded danger of ADHD, additionally with an obvious portion reaction impact (Kotimaa, A.J., et al 2003). Proof of natural tobacco introduction is additionally observed with inattentive-type ADHD. (Schmitz, M., et al 2006) discovered that offspring of moms who smoked in any event 10 cigarettes for each day during pregnancy were 3.44 occasions bound to have ADHDunmindful sort than kids whose moms did not smoke during pregnancy.

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CONCLUSION

In summary maternal smoking is a worldwide problem with long lasting effects on infant's development.

Due to its negative effects on infants, researchers worldwide have carried out studies to find its link on how it affects the foetus during the early weeks of pregnancy and have come to show its later effects on infant's development and childhood.
Low birth weight, sudden infant death syndrome, Oro-facial defects, poor cognition, conduct disorders and hyperactivity disorders are some of the major effects associated with maternal smoking on infant's development.

REFERENCES

REFERENCES
Abel, E.L., 1980. Smoking during pregnancy: A review of effects on growth and development of off-spring. Human biology, 52(4), p.593.
Altet, M.N., Alcaide, J., Plans, P., Taberner, J.L., Salto, E., Folguera, L. and Salleras, L., 1996. Passive smoking and risk of pulmonary tuberculosis in children immediately following infection. A case-control study. Tubercle and lung Disease, 77(6), pp.537-544.

Al-Turki, H.A., 2012. Prevalence and risk factors in women attending a tertiary care hospital in Saudi Arabia. Saudi Med J, 33(8), pp.875-878.

Amaratunga, D., Baldry, D., Sarshar, M. and Newton, R., 2002. Quantitative and qualitative research in the built environment: application of "mixed" research approach. Work study, 51(1), pp.17-31.
Button, T.M.M., Maughan, B. and McGuffin, P., 2007. The relationship of maternal smoking to psychological problems in the offspring. Early human development, 83(11), pp.727-732.
Byard, R.W. and Krous, H.F., 2003. Sudden infant death syndrome: overview and update. Paediatric and developmental pathology, 6(2), pp.112-127.

Camp, D.E., Klesges, R.C. and Relyea, G., 1993. The relationship between body weight concerns and adolescent smoking. Health psychology, 12(1), p.24.
Chiolero, A., Bovet, P. and Paccaud, F., 2005. Association between maternal smoking and low birth weight in Switzerland: the EDEN study. Swiss medical weekly, 135(35-36), pp.525-530.

Chrisman, J.J., Chua, J.H. and Sharma, P., 2005. Trends and directions in the development of a strategic management theory of the family firm. Entrepreneurship theory and practice, 29(5), pp.555-575.
Cohen, G., Roux, J.C., Grailhe, R., Malcolm, G., Changeux, J.P. and Lagercrantz, H., 2005. Perinatal exposure to nicotine causes deficits associated with a loss of nicotinic receptor function. Proceedings of the National Academy of Sciences, 102(10), pp.3817-3821.

Colley, J.R.T., Holland, W.W. and Corkhill, R.T., 1974. Influence of passive smoking and parental phlegm on pneumonia and bronchitis in early childhood. The Lancet, 304(7888), pp.1031-1034.
Dietz, P.M., England, L.J., Shapiro-Mendoza, C.K., Tong, V.T., Farr, S.L. and Callaghan, W.M., 2010. Infant morbidity and mortality attributable to prenatal smoking in the US. American journal of preventive medicine, 39(1), pp.45-52.

DiFranza, J.R. and Lew, R.A., 1995. Effect of maternal cigarette smoking on pregnancy complications and sudden infant death syndrome. The European Journal of General Practice, 1(3), pp.117-117.
Eaton, D.K., Kann, L., Kinchen, S., Shanklin, S., Flint, K.H., Hawkins, J., Harris, W.A., Lowry, R., McManus, T., Chyen, D. and Whittle, L., 2012. Youth risk behavior surveillance—United States, 2011. Morbidity and Mortality Weekly Report: Surveillance Summaries, 61(4), pp.1-162.
Elliot, J., Carroll, N., Bosco, M., McCROHAN, M.A.R.Y. and Robinson, P., 2001. Increased airway responsiveness and decreased alveolar attachment points following in utero smoke exposure in the guinea pig. American journal of respiratory and critical care medicine, 163(1), pp.140-144.
Elliot, J., Vullermin, P. and Robinson, P., 1998. Maternal cigarette smoking is associated with increased inner airway wall thickness in children who die from sudden infant death syndrome. American Journal of respiratory and critical care medicine, 158(3), pp.802-806.
England, L.J., Kendrick, J.S., Gargiullo, P.M., Zahniser, S.C. and Hannon, W.H., 2001. Measures of maternal tobacco exposure and infant birth weight at term.
American journal of epidemiology, 153(10), pp.954-960.

The Effect of Lifestyle Changes on Blood Pressure Control among Hypertensive Patients

Author: : Sylvester Siamisang

1. Department for Medical Laboratory Science, DDT College of Medicine.

2. Department of Medicine, DDT College of Medicine.

Corresponding Author Dr Derrick D. Tlhoiwe, Dr T Tlhoiwe, *Larry.L. Mweetwa*
Email: *journals@ddtcollegeofmedicine.com*

DDT College of Medicine,
P.O. Box 70587, Gaborone Botswana
Tel: +267(0)3904924/5
Cell: +267(0) 7710000
Fax: +267(0)3904935

Abstract|

Lifestyle modification, formerly called non-pharmacologic therapy, has a vital role in hypertensive as well as non-hypertensive individuals. In hypertensive individuals, lifestyle modifications can be implemented as initial treatment before the start of drug therapy and as an adjunct to medication in persons already on pharmacological treatment (Myung H.Y., et al 2017). In hypertensive patients with medication-controlled BP, these therapies can facilitate drug step-down and drug withdrawal in highly motivated individuals who achieve and sustain lifestyle changes (Whelton, P.K., et al 1998). In non-hypertensive, lifestyle modifications have the potential to prevent hypertension, and more broadly to reduce BP and thereby lower the risk of BP-related clinical complications in whole populations (Mills, K.T.., et al 2016).

Key words| Blood Pressure, Lifestyle changes, Hypertension

Background

Hypertension is an enormous public health issue, because it is a reversible risk factor for stroke, ischemic heart disease, congestive heart failure, renal failure and peripheral vascular disease (The Victoria declaration on heart health., 1992).

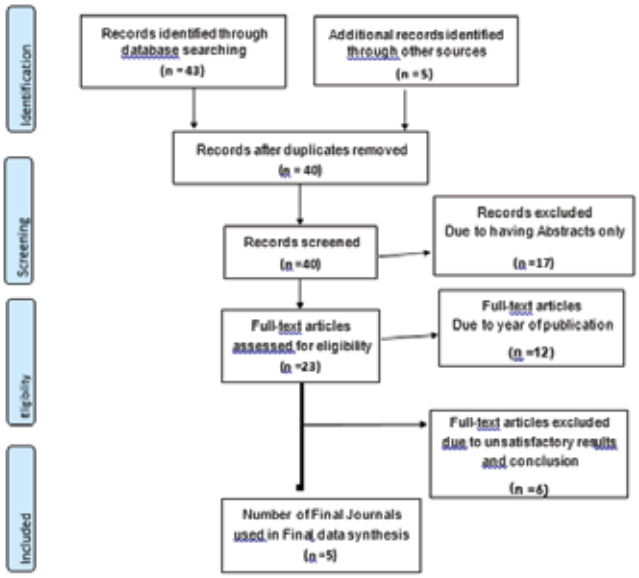
There is now general agreement that cardiovascular disease can be prevented by altering diet and lifestyle and by reducing risk factors. The 1992 Victoria Declaration on Heart Health further advised that a public health approach to the prevention and control of cardiovascular disease be adopted, one that promotes healthy dietary habits, a tobacco-free lifestyle, regular physical activity and a supportive psychosocial 2 environment. Through lifestyle modifications, including increased physical activity, maintenance of normal body weight, limited alcohol consumption, reduction of salt intake, increased potassium intake, and consumption of a diet high in fruits, vegetables, and low-fat dairy products, and low in saturated and total fat, should be the first choice for combating the emerging epidemic of hypertension in low- and middle-income countries (Neaton, J.D., et al 1993).

BURDEN OF HYPERTENSION

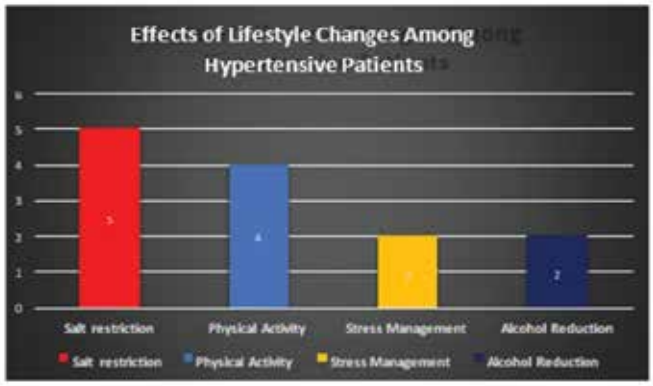
Hypertension is a key modifiable risk factor for cardiovascular diseases and stroke. Proper treatment of hypertension can reduce the risk of stroke up to 42% and the risk of coronary heart disease by about 14% (Chalmers, et al 1993) However, various lifestyle factors are associated with cardiovascular disease and hypertension, such as smoking, obesity,

diabetes, dyslipidaemia, and others. Lifestyle is a vital issue in managing hypertension since optimal therapy of the disease involves consideration of the patient's age, sex, race, diet, exercise, tobacco use,

Fig 1.0 | Prisma Flow Chart



1.2| KEY RESULTS AND DISCUSSION



DATA ANALYSIS AND INTERPRETATION

Salt reduction on BP control

There is much evidence demonstrating that reduction in salt intake lowers blood pressure (BP). In hypertensive patients, mostly those over the age of 44 years, it is recommended that the intake of dietary Sodium be moderately limited to a target range of 90–130 mmol per day(Ryan, T.J., et al 1996)

The evidence comes from different types of studies including epidemiological, migration, population-based intervention, genetic and animal studies, as well as treatment trials (Poulter., et al 1990). As raised BP throughout its range is a major cause of cardiovascular disease, a reduction in salt intake lowers BP and, therefore, would reduce cardiovascular risk. Indeed, both prospective cohort studies and outcome trials have demonstrated that a lower salt intake is related to a reduced risk of cardiovascular disease (Strazzullo., et al 2009).

The term "salt sensitivity "has been commonly used to describe the variations of BP response to salt reduction. According to meta-analysis by (He., et al 2013) demonstrates that a longer-term modest reduction in salt intake of 4.4 g/d on average, causes significant and, from a population viewpoint, important falls in BP in individuals with both raised and normal BP. The BP falls, on average, by 5/3 mmHg in hypertensive and 2/1 mmHg in normotensives. Further subgroup analyses demonstrate that a modest reduction in salt intake leads to a significant fall in systolic BP in both whites and blacks, men and women. The current recommendations to reduce salt intake from 9-12 to 5-6 g/d will have a major effect on BP, but are not ideal. A further reduction to 3 g/d will have a greater effect and should become the long term target for population salt intake.

Effect of increased physical activity on BP control

The factors associated with the potential antihypertensive effects of long-term aerobic exercise are not completely understood, while a reduction in sympathetic activity and an improvement in endothelial function have been proposed as mechanisms affecting blood pressure (Goto. C., et al 2003) In one randomized trial, patients with a recent myocardial infarction showed improved baroreceptor sensitivity and reduced muscle sympathetic nerve activity with exercise training (MacMahon, S., et al 2011). Another study that compared muscle biopsies in patients with hypertension before and after an exercise program documented decreased levels of the vasoconstrictor thromboxane and increased levels of the vasodilator prostacyclin () In our study, we used MET scores to assess physical activity and observed changes within 12 weeks of treatment.

The adjusted OR for the answer "no" for increased physical activity (which included no change or a decreased MET score after 12 weeks) was 0.43 for successful blood pressure control. CURRENT guidelines for the management of hypertension recommend aerobic exercise as a means of blood pressure reduction to be used prior to, and in conjunction with, pharmacological approaches.
(Bruno, R.M, et al, 2016)The guidelines typically recommend a programme of moderate intensity aerobic exercise (such as brisk walking) to be carried out for at least 30 minutes on five or more days each week. This prescription is the same as recent recommendations for the appropriate amount of exercise required to maintain health and, as such, is likely to be widely utilized in general practice (Hagberg, J.M., et al, 2000). The guidelines are derived from strong and consistent epidemiological evidence that moderate intensity physical activity carried out over a number of years confers significant protection from the development of cardiovascular disease. However, there is relatively little evidence from experimental studies of the short-term improvements in cardiovascular risk factors that might be gained by patients following such an exercise programme. (Ryan, T.J., et al, 1996)

Stress management

Individualized Strategies in terms of cognitive behavioral stress therapy were applied, such as increasing attentiveness to stressors and stress responses, re-evaluating negative life events, communications skills training (e.g., marital communication and assertiveness training), improvement of problem-solving skills, controlling of negative emotions (e.g., anger and anxiety) and methods for lowering sympathetic stimulation(e.g., relaxation exercises) (Arkwright, P.D., et al, 1982). The change in blood pressure with such interventions was –1.5 to +2.9/–0.8 to+1.2 mm Hg, whereas the change was –9/–6 mm Hg in a second meta-analysis.(Bruno, R.M, et al, 2016). In contrast, multicomponent individualized cognitive behavioral interventions decrease blood pressure to a greater degree and over a longer period of time. Linden and Chambers performed a meta-analysis and found that blood pressure was reduced by 9.7/7.2 mm Hg with multicomponent relaxation techniques (Bruno, R.M, et al, 2016). With individualized cognitive stress management, blood pressure was reduced on average by15.2/9.2 mm Hg. The key to this approach is tailoring the intervention to the patient's needs. There was no grade I evidence of effects on morbidity or mortality rates.

Alcohol reduction

Prevention of hypertension and lowering blood pressure with non-pharmacological treatment and lifestyle changes may reduce cardiovascular morbidity and mortality associated with alcohol while they also play a significant role in reducing the cost of medical treatment. Reduction of alcohol consumption is one of the indorsed lifestyle changes in the (JNC VII report 1993). A positive relationship has been noticed between decreasing alcohol consumption and systolic and diastolic blood pressures (Potter .., et al 1984). Reducing alcohol intake provides a 2-4 mmHg reduction in systolic blood pressure levels. For this reason, 1-2 drinks per day for men and up to one drink for women and people with poor health seem to be optimal amounts. People who use alcohol should keep in mind that moderation and limited consumption are the key words in avoiding alcohol related medical conditions (Parker, M .,et al 1990). Data from overviews of observational studies and randomized trials suggest that a 2-mm Hg reduction in diastolic BP would be expected to result in a 17% decrease in the prevalence of hypertension, a 6% reduction in the risk of coronary heart disease, and a 15% reduction in the risk of stroke and transient ischemic attacks. (Cook NR, et al, 1995).

CONCLUSION

Hypertension can be controlled by application of strategies that target the individuals at higher risk for high blood pressure. Lifestyle modification by means of salt restriction, decreased alcohol intake, increased physical activity and stress management are more likely to be successful in lowering blood pressure thus reducing the risk of hypertension complications. The reduction of hypertension is likely to be significant when targeted people are older, therefore I suggest that health care workers should emphasize weight loss for overweight patients, abstinence or moderation in alcohol intake, regular exercise and restriction of salt intake. Stress management should be considered an intervention if stress appears to be an important issue by initiating individualized cognitive behavioral therapy. In conclusion combination of lifestyle changes can significantly decrease blood pressure and they should always be a part of management plan.

REFERENCES

Akinkugbe, O.O. and Akinyanju, O.O., 1997. Final Report-national Survey on noncommunicable diseases in Nigeria. Lagos: Federal Ministry of Health, pp.65-68.

Arkwright, P.D., Beilin, L.J., Rouse, I., Armstrong, B.K. and Vandongen, R., 1982. Effects of alcohol use and other aspects of lifestyle on blood pressure levels and prevalence of hypertension in a working population. Circulation, 66(1), pp.60-66.

Bruno, R.M., Pucci, G., Rosticci, M., Guarino, L., Guglielmo, C., Rosei, C.A., Monticone, S., Giavarini, A., Lonati, C., Torlasco, C. and Fedecostante, M., 2016. Association between lifestyle and systemic arterial hypertension in young adults: a national, survey-based, cross-sectional study. High Blood Pressure & Cardiovascular Prevention, 23(1), pp.31-40.

Chalmers, J.O.H.N., MacMahon, S., Mancia, G., Whitworth, J., Beilin, L., Hansson, L., Neal, B., Rodgers, A., Ni, C.M. and Clark, T., 1999. 1999 World Health Organization-International Society of Hypertension Guidelines for the management of hypertension. Guidelines sub-committee of the World Health Organization. Clinical and experimental hypertension (New York, NY: 1993), 21(5-6), pp.1009-1060.

Cook, N.R., Cohen, J., Hebert, P.R., Taylor, J.O. and Hennekens, C.H., 1995. Implications of small reductions in diastolic blood pressure for primary prevention. Archives of Internal Medicine, 155(7), pp.701-709.

Goto, C., Higashi, Y., Kimura, M., Noma, K., Hara, K., Nakagawa, K., Kawamura, M., Chayama, K., Yoshizumi, M. and Nara, I., 2003. Effect of different intensities of exercise on endothelium-dependent vasodilation in humans: role of endotheliumde-pendent nitric oxide and oxidative stress. Circulation, 108(5), pp.530-535

Hagberg, J.M., Park, J.J. and Brown, M.D., 2000. The role of exercise training in the treatment of hypertension. Sports medicine, 30(3), pp.193-206.

Ibrahim, M.M. and Damasceno, A., 2012. Hypertension in developing countries. The Lancet, 380(9841), pp.611-619.

Kadiri S, Walker O, Salako BL, Akinkugbe OO. Blood pressure, hypertension and correlates in urbanized workers in Ibadan, Nigeria – a revisit. J Hum Hypertens 1999;13:23–7.

MacMahon, S., Peto, R., Collins, R., Godwin, J., Cutler, J., Sorlie, P., Abbott, R., Neaton, J., Dyer, A. and Stamler, J., 1990. Blood pressure, stroke, and coronary heart disease: part 1, prolonged differences in blood pressure: prospective observational studies corrected for the regression dilution bias. The Lancet, 335(8692), pp.765-774.

Mills, K.T., Bundy, J.D., Kelly, T.N., Reed, J.E., Kearney, P.M., Reynolds, K., Chen, J. and He, J., 2016. Global disparities of hypertension prevalence and control: a systematic analysis of population-based studies from 90 countries. Circulation, 134(6), pp.441-450.

Myung Hwan Yhang., et al, 2017. The Effect of Lifestyle Changes on Blood Pressure Control Among Hypertensive Patients. Lifestyle Changes and Blood Pressure control

Neaton, J.D., Grimm, R.H., Prineas, R.J., Stamler, J., Grandits, G.A., Elmer, P.J., Cutler, J.A., Flack, J.M., Schoenberger, J.A., McDonald, R. and Lewis, C.E., 1993. Treatment of mild hypertension study: final results. Jama, 270(6), pp.713-724.

Potter, J.F. and Beevers, D.G., 1984. Pressor effect of alcohol in hypertension. The Lancet, 323(8369), pp.119-122.

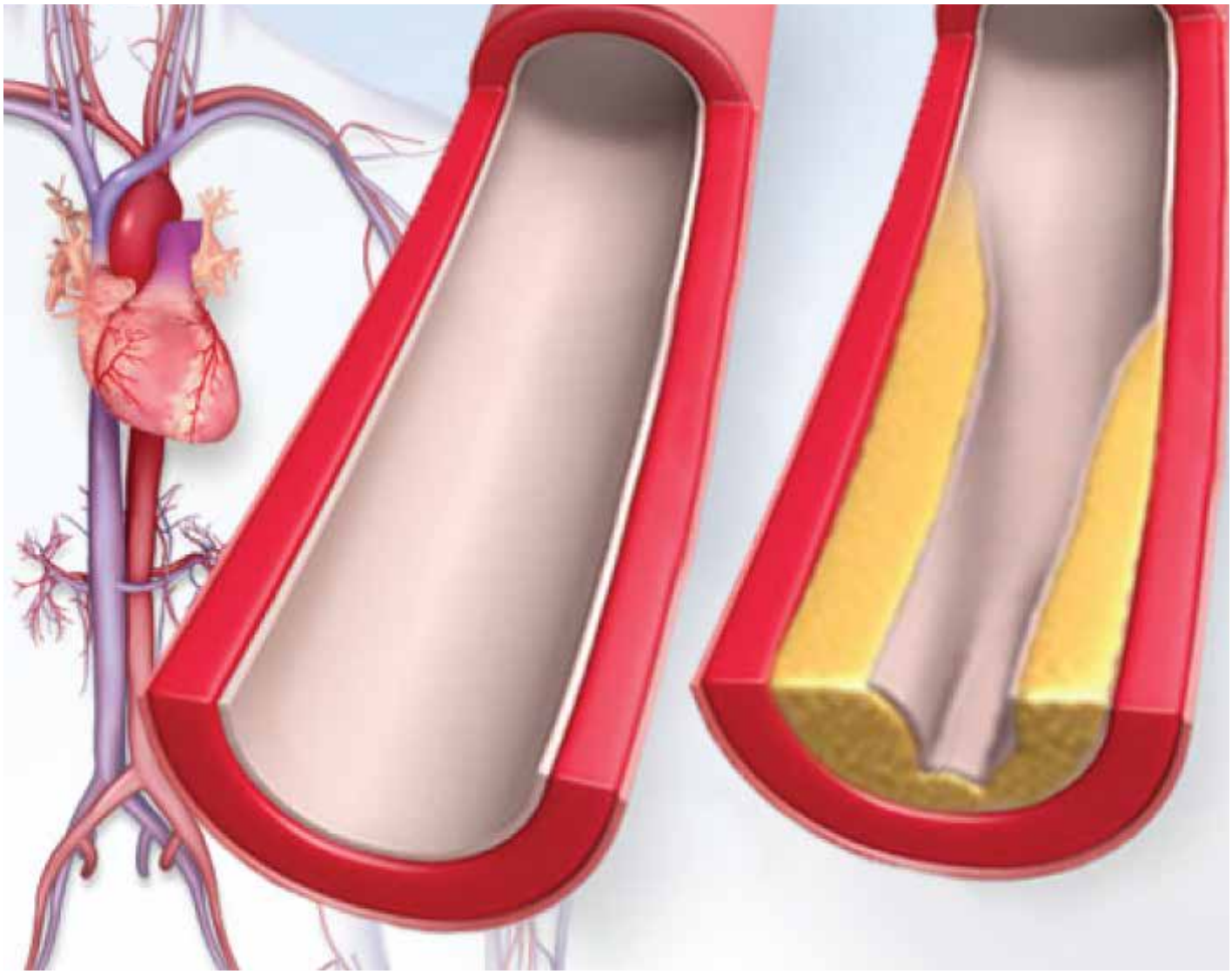
Pickering, T., 1996. Recommendations for the use of home (self) and ambulatory blood pressure monitoring. American Journal of Hypertension, 9(1), pp.1-11.

Poulter, N.R., Khaw, K.T., Hopwood, B.E.C., Mugambi, M., Peart, W.S., Rose, G. and Sever, P.S., 1990. The Kenyan Luo migration study: observations on the initiation of a rise in blood pressure. Bmj, 300(6730), pp.967-972.

Ryan, T.J., Anderson, J.L., Antman, E.M., Braniff, B.A., Brooks, N.H., Califf, R.M., Hillis, L.D., Hiratzka, L.F., Rapaport, E., Riegel, B.J. and Russell, R.O., 1996. ACC/AHA guidelines for the management of patients with acute myocardial infarction: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee on Management of Acute Myocardial Infarction). Journal of the American College of Cardiology, 28(5), pp.1328-1419

Trilling, J.S. and Froom, J., 2000. The urgent need to improve hypertension care. Archives of Family Medicine, 9(9), pp.794-801.

Whelton, S.P., Chin, A., Xin, X. and He, J., 2002. Effect of aerobic exercise on blood pressure: a meta-analysis of randomized, controlled trials. In Database of Abstracts of Reviews of Effects (DARE): Quality-assessed Reviews [Internet]. Centre for Reviews and Dissemination (UK).



THE EFFECT OF LIFESTYLE CHANGES ON BLOOD PRESSURE CONTROL AMONG HYPERTENSIVE PATIENTS

Author: : Lucky Amogelang Kobamelo

1. Department for Medical Laboratory Science, DDT College of Medicine.

2. Department of Medicine, DDT College of Medicine.

Corresponding Author Dr Derrick D. Tlhoiwe, Dr T Tlhoiwe, *Larry.L. Mweetwa*
Email: *journals@ddtcollegeofmedicine.com*

DDT College of Medicine,
P.O. Box 70587, Gaborone Botswana
Tel: +267(0)3904924/5
Cell: +267(0) 7710000
Fax: +267(0)3904935

Abstract |

Much evidence has emerged on the significance of lifestyle modification of hypertension control, its efficacy and safety as management. However, fewer studies exist that put an emphasis on healthy lifestyle choices (balanced diet, increased physical activity) and the vital role they have on hypertension control in Botswana. The purpose of this study was to give a detailed review on The Effects of Lifestyle Changes on Blood Pressure Control among Hypertensive Patients. . A computerized search was done in four different data bases published, Google, PubMed, Medline and Embase on the 20th June 2019. A thorough step by step guidance of the PRISMA checklist was followed. The practicality of the selected studies was analyzed using PICOS checklist. To conclude on the consistency of the selected studies, the current review assessed; 1) description of the measures implemented, 2) results of the measures implemented and 3) population characteristics. 5 studies were found eligible, overall; low salt intake, reduced alcohol intake, smoking cessation, BMI control and stress management could be summarized to have an effect on hypertension control, however most of these measures have a higher impact on hypertension reduction when implemented together.

Key words | Hypertension, Lifestyle modification, Salt reduction, weight reduction.

Background

The theoretical part of the research is covered in this chapter. It discusses pragmatic studies and prior literature, on effects of lifestyle modification on blood pressure control among hypertensive patients. The statistical data about effects of lifestyle modification on blood pressure control among hypertensive patients, is also deliberated in the perspective of various countries, and across the globe. A thorough explanation on concepts and different researches on effects of lifestyle modification on blood pressure control among hypertensive patients have been discussed.
Further information of this research and considerable amount of theoretical and statistical data is presented and evaluated in this chapter. It also highlights and pinpoints the key findings from the review. Hypertension is a key modifiable risk factor for cardiovascular diseases and stroke.

Proper treatment of hypertension can reduce the risk of stroke up to 42% and the risk of coronary heart disease by about 14% (Collins, R., et al 1990) However, various lifestyle factors are associated with cardiovascular disease and hypertension, such as smoking, obesity, diabetes, dyslipidemia, and others. Lifestyle is a vital issue in managing hypertension since optimal therapy of the disease involves consideration of the patient's age, sex, race, diet, exercise, tobacco use, comorbid conditions, use of antihypertensive drug treatment, compliance, and achievement of blood pressure control (Trilling, J.S., et al 2000). (Bruno, R.M., et al 2016) studied the prevalence of systemic arterial hypertension and its association with modifiable risk factors in young adults.

Male sex, adiposity, and alimentary habits were identified as the main determinants of high blood pressure values, and therefore, were identified as factors for healthy lifestyle interventions. Approximately 20% of the adult population worldwide has hypertension. In 2013, the prevalence of hypertension included 27.3% of Korean adults, aged over 30 years (Yang, M.H., et al 2017). Salt reduction on blood presure control. The current public health recommendations in most countries are to reduce salt intake from approximately 9-12 g/d to 5-6 g/d (WHO 2003; SACN 2003). There is much evidence demonstrating that such a reduction in salt intake lowers blood pressure (BP).

In hypertensive patients, particularly those over the age of 44 years, it is recommended that the intake of dietary Sodium be moderately restricted to a target range of 90–130 mmol per day(J. George Fodor., et al 1999) .The evidence comes from different types of studies including epidemiological, migration, population-based intervention, genetic and animal studies, as well as treatment trials (Elliott., et al 1996, Poulter., et al 1990., Forte., et al 1989 Lifton., et al 1996., Denton., et al 1995., He., et al 2002). The term salt sensitivity has been commonly used to describe the variations of BP response to salt reduction. However, almost all of the studies on salt sensitivity have used a protocol of very large and sudden changes in salt intake. Such studies are irrelevant to the public health recommendations of more modest reduction in salt intake for a prolonged period of time.
According to (He., et al 2013) meta-analysis demonstrates that a longer-term modest reduction in salt intake has a significant effect on BP in both hypertensive and normotensive individuals, men and women, whites and blacks; although there is a variation in the extent of the fall in BP. These results in conjunction with other evidence (He 2010), particularly that a reduction in salt intake also lowers blood pressure in children (He 2006), provide strong support that salt reduction should be carried out in the whole population. A reduction in population salt intake lowers population BP. Even a small reduction of BP across the entire population would have a large impact on reducing the burden of cardiovascular disease (Whelton. et al 2002). According to meta-analysis by (He., et al 2013) demonstrates that a longer-term modest reduction in salt intake of 4.4 g/d on average, causes significant and, from a population viewpoint, important falls in BP in individuals with both raised and normal BP. The BP falls, on average, by 5/3 mmHg in hypertensives and 2/1 mmHg in normotensives. Further subgroup analyses demonstrate that a modest reduction in salt intake leads to a significant fall in systolic BP in both whites and blacks, men and women. These results provide further strong support for a reduction in population salt intake which will result in a lower population BP and, thereby, a reduction in strokes, heart attacks and heart failure. The INTERSALT study (International Study of Salt and Blood Pressure) suggested a strong relationship between salt intake and a progressive increase in BP with age, i.e. 0.4mmHg per year for a 6 g/d salt intake (Elliott 1996).

Effect of increased physical activity on bp control

The factors associated with the potential antihypertensive effects of long-term aerobic exercise are not completely understood, while a reduction in sympathetic activity and an improvement in endothelial function have been proposed as mechanisms affecting blood pressure (Goto. C., et al 2003) In one randomized trial, patients with a recent myocardial infarction showed improved baroreceptor sensitivity and reduced muscle sympathetic nerve activity with exercise training (Martinez, D.G., et al 2011). Another study that compared muscle biopsies in patients with hypertension before and after an exercise program documented decreased levels of the vasoconstrictor thromboxane and increased levels of the vasodilator prostacyclin. In our study, we used MET scores to assess physical activity and observed changes within 12 weeks of treatment. The adjusted OR for the answer "no" for increased physical activity (which included no change or a decreased MET score after 12 weeks) was 0.43 for successful blood pressure control. CURRENT guidelines for the management of hypertension recommend aerobic exercise as a means of blood pressure reduction to be used prior to, and in conjunction with, pharmacological approaches. (Burt VL, et al, 1995)The guidelines typically recommend a programme of moderate intensity aerobic exercise (such as brisk walking) to be carried out for at least 30 minutes on five or more days each week. (Arch intern med, 1997)

Alcohol reduction

Reduction of alcohol consumption is one of the indorsed lifestyle changes in the (JNC VII report 1993). Excessive amounts of alcohol intake leads to an increase in blood pressure in both normotensive and hypertensive individuals. At the same time, alcohol can lead to resistance to antihypertensive drug treatment. Effects of alcohol on blood pressure depends on the amount of alcohol rather than the type of alcohol (Schnall.., et al 1992). As far as heart diseases are concerned, mild-to moderate

alcohol intake, despite its tendency to increase blood pressure, is associated with lowering the risk of coronary artery diseases and ischemic stroke by way of elevating high-density lipoprotein cholesterol levels, reducing fibrinogen and platelet aggregation, and producing positive effects on antioxidants systems (klatsky.., et al 1997). However, increased alcohol consumption is accompanied by elevating blood pressure, hemorrhagic an ischemic strokes, alcohol-induced cardiomyopathy, arrhythmia, and sudden cardiac death. Therefore, people with hypertension should avoid or reduce alcohol consumption in addition to drug treatment (Arkwright.., et al 1982). Reducing alcohol intake provides a 2-4 mmHg reduction in systolic blood pressure levels. For this reason, 1-2 drinks per day for men and up to one drink for women and people with poor health seem to be optimal amounts. Prospective epidemiological studies have showed that persons with a low to moderate alcohol intake have a reduced risk for coronary heart disease, stroke, and all-cause mortality compared with nondrinkers.(Berger K, et al, 1999) The BP-lowering effects of alcohol reduction in the present study are similar to those noted with potassium supplementation or sodium reduction. (Whelton PK, et al, 1997)

Stress management

Individualized Strategies in terms of cognitive behavioral stress therapy were applied, such as increasing attentiveness to stressors and stress responses, reevaluating negative life events, communications skills training improvement of problem-solving skills, controlling of negative emotions (e.g., anger and anxiety) and methods for lowering sympathetic stimulation(e.g., relaxation exercises).(Spence, et al, 1999) There is no evidence that stress management averts hypertension, however there is some proof that stress management can lower blood pressure in hypertensive patients (Eisenberg DM, et al, 1993). A third meta-analysis showed a related pattern, although the differences between individualized cognitive stress management and other paired or single-component interventions was not as marked (Jacob RG, et al, 1991) .In contrast, multicomponent individualized cognitive behavioral interventions decrease blood pressure to a greater degree and over a longer period of time. Linden and Chambers performed a meta-analysis and found that blood pressure was reduced by 9.7/7.2 mm Hg with multicomponent relaxation techniques (Linden W, et al, 1994). One small study (Shapiro D, et al, 1997) showed a significant reduction in requirement for antihypertensive medication with a multicomponent cognitive behavioral intervention. After 12 months blood pressure was controlled without medication in 55% of the treatment group but only 30% of the control patients.

RESEARCH AIM

To assess the effect of lifestyle changes on blood pressure control among hypertensive patients.

OBJECTIVE

1. To identify strategies that promote lifestyle changes on blood pressure
2. To determine the efficacy of lifestyle modification as a mode of intervention in diagnosed hypertensive patients
3. To review existing literature to come up with better ways of managing hypertensive patients without drug burden
4. To review existing literature in order sensitize patients on the importance and gains of a healthy life style as both a preventative and therapeutic intervention of Hypertension.

METHODOLOGY

In order to answer the aims and objectives of the research topic, secondary data was systematically reviewed. The databases used for attaining the information included PubMed, Google scholar. The utilization of the multiple databases presented the opportunity to gain accurate and reliable information that signified the primary aspects of the study. Also, the research study used the PRISMA tool for screening the research resources.

RESULTS

Identified studies were uploaded into endnote (Thomas Reuters) and duplicates were removed. 4 reviewers vetted through the study based on the topic and abstracts that met the inclusion criteria. Studies selected after the first screening were further screened through a detailed full text browsing, to further exclude studies that had some of the exclusion criteria. Out of 58 studies identified, 10 were excluded as they were duplicates, 20 were further excluded as they were abstract only and 18 more excluded because of year of publication. Out of the 10 selected, 3 were further excluded because each had 1 or 2 exclusion criteria. And only 7 were used.

Fig 1.0 | Prisma Flow Chart

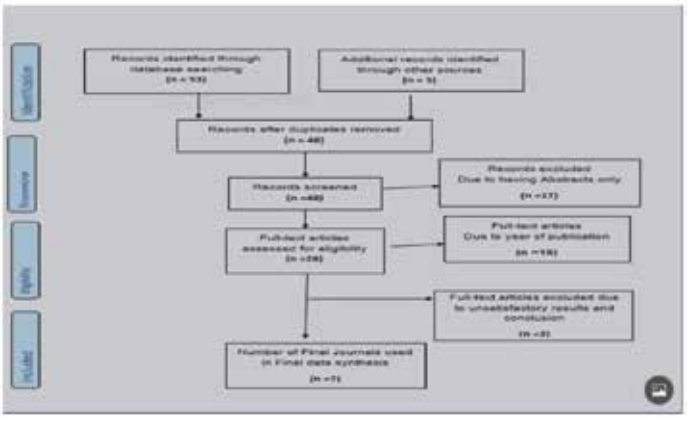
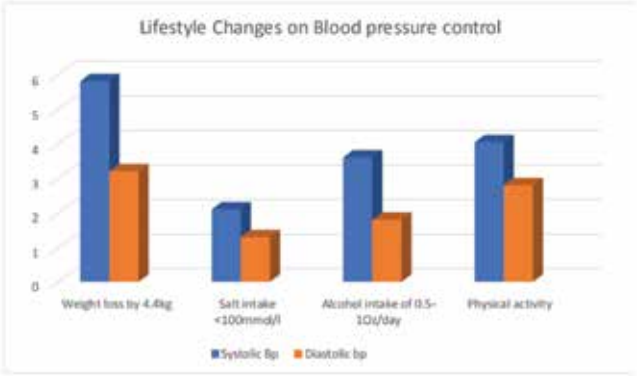


Fig 1.2| KEY RESULTS AND DISCUSSION



DATA ANALYSIS AND INTERPRETATION

The Dietary salt

Salt restriction showed decrease in both systolic and diastolic blood pressure when used as adjunct therapy to pharmacological management. Reduction in daily sodium intake of up to 100mol/L a day resulted in significant decrease in blood pressure in hypertensive patients above 44 years of age. (Campbell, et al, 1999) Although decrease in dietary sodium is beneficial, lower than 89mmol/L was associated with an increased risk for myocardial infarction. Restriction of salt intake on normotensive participants was not recommended as no evidence was found to support a decrease in chances of developing hypertension. (Fodor, et al, 1999)

Alcohol reduction

Various studies reviewed shows that alcohol intake at a high dose increases the rate of elevated blood pressure whereas mild to moderate intake decreases risks of coronary diseases (Schnall.., et al 1992). It has also been shown that it's not the type of alcohol that causes high blood pressure but the amount of alcohol a person consumes. (Klatsky., et al 1997). However, increased alcohol consumption is accompanied by elevating blood pressure, hemorrhagic and ischemic strokes, alcohol-induced cardiomyopathy, arrhythmia, and sudden cardiac death. Therefore, people with hypertension should avoid or reduce alcohol consumption in addition to drug treatment (Arkwright.., et al 1982).

Stress management

In paying closer attention to stressors and stress responses, as well as change in percerption towards negative life events and improving the ability to well articulate thoughts and feelings while learning the proper way to react in problematic situations has led to a downward significant lowering of blood pressure in patients who had an elevated high blood pressure as well as stress. (Spence, et al, 1999). Studies reviewed also showed that methods for lowering sympathetic stimulation like relaxation exercises also proved to bear fruits in reducing the level of blood pressure (Stevens JH et al, 1984) .There is no concrete proof that stress management forestalls hypertension in normotensive people, however there is some evidence that stress management can lower blood pressure in hypertensive patients (Eisenberg DM, et al, 1993). Changes in blood pressure were with stress management was noted to be around –1.5 to +2.9/–0.8 to+1.2 mm Hg and –9/–6 mm Hg.(Linden W, et al, 1994).

Weight loss/reduction and increased physical activity.

An increase in BMI showed a rise in blood pressure in a few months among hypertensive patients as opposed to a decrease in BMI (Myung, et al 2017) thus weight loss should be advised in all patients, especially obese people, even if it's just mild weight loss as it proved vital in decreasing hypertension and decreasing the risks of stroke and Coronary artery diseases (Whelton, et al, 2016). Increased vigorous physical activity has proven to be of outmost importance in the control of blood pressure and in the maintenance of the preferred body weight in hypertensive patients (Arch intern med, 1997).

Furthermore physical activity as little as walking in 30 minutes has illustrated a substantially low or controlled blood pressure in both hypertensive and normotensive patients (Myung, et al 2017)

CONCLUSION

Even though increased physical activity, alcohol reduction, reducing weight, stress control and decreased salt intake individually showed considerable beneficial results in the management of Hypertension, several studies illustrated exponential blood pressure reduction when they were used as a combination therapy and in some studies these modification revealed to be just as efficacious as some Hypertensive medications.

All patients would benefit from general advice on healthy lifestyle habits, in particular healthy body weight, most especially weight loss in all patients, with greater focus on obese people, even if it's just mild weight loss. Moderate consumption of alcohol has been proven vital in reducing blood pressure as well as in decreasing risks of secondary morbidity and mortality especially less than 15ml a week of alcohol for women and 30ml a week of alcohol for men.

Regular exercise of 1 hour of cardio daily has proven of value in decreasing body weight as well as in the reduction of hypertension, both the systolic and diastolic values. It is worth noting that for hypertensive patients with concomitant stress disorders/issues, management of stress should be considered as a vital intervention. In conclusion Weight gain, physical inactivity, and high salt intake were associated with inadequate blood pressure control.

Akinkugbe, O.O. and Akinyanju, O.O., 1997. Final Report-national Survey on non?communicable diseases in Nigeria. Lagos: Federal Ministry of Health, pp.65-68.
Akinyi, H., Oti, S., Olajide, A., Agyemang, C., Aboderin, I. and Kyobutungi, C., 2013.

Status report on hypertension in Africa--consultative review for the 6th Session of the African Union Conference of Ministers of Health on NCD's. The Pan African medical journal, 16, pp.38-38.
Arnold, M., Pandeya, N., Byrnes, G., Renehan, A.G., Stevens, G.A., Ezzati, M.,
Ferlay, J., Miranda, J.J., Romieu, I., Dikshit, R. and Forman, D., 2015. Global burden of cancer attributable to high body-mass index in 2012: a population-based study. The Lancet Oncology, 16(1), pp.36-46
Appel LJ, Champagne CM, Harsha DW, Cooper LS, Obarzanek E, Elmer PJ et al.
Effects of comprehensive lifestyle modification on blood pressure control: main results of the PREMIER clinical trial. JAMA 2003; 289(16): 2083–2093
Arkwright, P.D., Beilin, L.J., Rouse, I., Armstrong, B.K. and Vandongen, R., 1982.

Effects of alcohol use and other aspects of lifestyle on blood pressure levels and prevalence of hypertension in a working population. Circulation, 66(1), pp.60-66.
Bloomfield, R.O.B.E.R.T., Young, L.D. and Graves, J.O.H.N., 1993. Racial differences in perceptions concerning hypertension and its consequences. Southern medical journal, 86(7), pp.767-770.

Bompiani, G.D., Cerasola, G., Morici, M.L., Condorelli, M., Trimarco, B., De, N.L., Leonetti, G., Sampieri, L., Cuspidi, C. and Cottone, S., 1988. Effects of moderate low sodium/high potassium diet on essential hypertension: results of a comparative study. International journal of clinical pharmacology, therapy, and toxicology, 26(3), pp.1
Bovet P, Ross AG, Gervasoni JP, Mkamba M, Mtasiwa DM, Lengeler C et al. Distribution of blood pressure, body mass index and smoking habits in the urban population of Dar es Salaam, Tanzania, and associations with socioeconomic status. Int J Epidemiol 2002; 31(1): 240–247
Bruno, R.M., Pucci, G., Rosticci, M., Guarino, L., Guglielmo, C., Rosei, C.A., Monticone, S., Giavarini, A., Lonati, C., Torlasco, C. and Fedecostante, M., 2016. Association between lifestyle and systemic arterial hypertension in young adults: a national, survey-based, cross-sectional study. High Blood Pressure & Cardiovascular Prevention, 23(1), pp.31-40.
Cappuccio FP, Plange-Rhule J, Phillips RO, Eastwood JB. Prevention of hypertension and stroke in Africa. Lancet 2000; 356(9230): 677–67829-132.

Chalmers, J.O.H.N., MacMahon, S., Mancia, G., Whitworth, J., Beilin, L., Hansson, L., Neal, B., Rodgers, A., Ni, C.M. and Clark, T., 1999. 1999 World Health Organization-International Society of Hypertension Guidelines for the management of hypertension. Guidelines sub-committee of the World Health Organization. Clinical and experimental hypertension (New York, NY: 1993), 21(5-6), pp.1009-1060.

Chobanian, A.V., Bakris, G.L., Black, H.R., Cushman, W.C., Green, L.A., Izzo Jr,J.L., Jones, D.W., Materson, B.J., Oparil, S., Wright Jr, J.T. and Roccella, E.J., 2003. The seventh report of the joint national committee on prevention, detection, evaluation, and treatment of high blood pressure: the JNC 7 report. Jama, 289(19), pp.2560-2571.

Chobanian, A.V., Bakris, G.L., Black, H.R., Cushman, W.C., Green, L.A., Izzo Jr, J.L., Jones, D.W., Materson, B.J., Oparil, S., Wright Jr, J.T. and Roccella, E.J., 2003. The seventh report of the joint national committee on prevention, detection, evaluation, and treatment of high blood pressure: the JNC 7 report. Jama, 289(19), pp.2560-2571.Hagberg, J.M., Park, J.J. and Brown, M.D., 2000. The role of exercise training in the treatment of hypertension. Sports medicine, 30(3), pp.193-206.

Cook, N.R., Cohen, J., Hebert, P.R., Taylor, J.O. and Hennekens, C.H., 1995. Implications of small reductions in diastolic blood pressure for primary prevention. Archives of Internal Medicine, 155(7), pp.701-709.

Douglas JG, Bakris GL, Epstein M, Ferdinand KC, Ferrario C, Flack JM et al. Management of high blood pressure in African Americans: consensus statement of the Hypertension in African Americans Working Group of the International Society on Hypertension in Blacks. Arch Intern Med 2003; 163(5): 525–541.

Feigin, V.L., Lawes, C.M. and Bennett, D.A., 2008. Worldwide stroke incidence and early case fatality reported in 56 population-based studies. A systematic review, 2009, p.8.
Fodor, J.G., Whitmore, B., Leenen, F. and Larochelle, P., 1999. Lifestyle modifications to prevent and control hypertension. 5. Recommendations on dietary salt. Canadian Hypertension Society, Canadian Coalition for High Blood Pressure Prevention and Control, Laboratory Centre for Disease Control at Health Canada, Heart and Stroke Foundation of Canada. CMAJ: Canadian Medical Association Journal, 160(9), p.S29.

Goto, C., Higashi, Y., Kimura, M., Noma, K., Hara, K., Nakagawa, K., Kawamura, M., Chayama, K., Yoshizumi, M. and Nara, I., 2003. Effect of different intensities of exercise on endothelium-dependent vasodilation in humans: role of endothelium?dependent nitric oxide and oxidative stress. Circulation, 108(5), pp.530-535.
Grassi, G., Cifkova, R., Laurent, S., Narkiewicz, K., Redon, J., Farsang, C., Viigimaa, M., Erdine, S., Brambilla, G., Bombelli, M. and Dell'Oro, R., 2010. Blood pressure control and cardiovascular risk profile in hypertensive patients from central and eastern European countries: results of the BP-CARE study. European heart journal, 32(2), pp.218-225.

Hien, H. A., 2018. Prevalence, awareness, treatment and control of hypertension and its risk factors in central vietnam. international journal of hypertension.
Ibrahim, M.M. and Damasceno, A., 2012. Hypertension in developing countries. The Lancet, 380(9841), pp.611-619.
Kadiri S, Walker O, Salako BL, Akinkugbe OO. Blood pressure, hypertension and correlates in urbanized workers in Ibadan, Nigeria – a revisit. J Hum Hypertens 1999;13:23–7.

Kearney, P.M., Whelton, M., Reynolds, K., Muntner, P., Whelton, P.K. and He, J., 2005. Global burden of hypertension: analysis of worldwide data. The lancet, 365(9455), pp.217-223.
Klatsky, A.L., Friedman, G.D., Siegelaub, A.B. and Gérard, M.J., 1977. Alcohol consumption and blood pressure: Kaiser-Permanente multiphasic health examination data. New England Journal of Medicine, 296(21), pp.1194-1200.

Kohlbacher, F., 2006. The use of qualitative content analysis in case study research. In Forum Qualitative Sozialforschung/Forum: Qualitative Social Research (Vol. 7, No. 1, pp. 1-30). Institut für Qualitative Forschung.Lieber, C.S., 1995. Medical disorders of alcoholism. New England Journal of Medicine, 333(16), pp.1058-MacMahon, S., Peto, R., Collins, R., Godwin, J., Cutler, J., Sorlie, P., Abbott, R., Neaton, J., Dyer, A. and Stamler, J., 1990. Blood pressure, stroke, and coronary heart disease: part 1, prolonged differences in blood pressure: prospective observational studies corrected for the regression dilution bias. The Lancet, 335(8692), pp.765-774.

Midgley, J.P., Matthew, A.G., Greenwood, C.M.T. and Logan, A.G., 1996. Effect of reduced dietary sodium on blood pressure: a meta-analysis of randomized controlled trials. Jama, 275(20), pp.1590-1597.Mills, K.T., Bundy, J.D., Kelly, T.N., Reed, J.E., Kearney, P.M., Reynolds, K., Chen,J. and He, J., 2016. Global disparities of hypertension prevalence and control: a systematic analysis of population-based studies from 90 countries. Circulation, 134(6), pp.441-450.
Myung Hwan Yhang, e. a., 2017. The Effect of Lifestyle Changes on Blood Pressure Control Among Hypertensive Patients. Lifestyle Changes and Blood Pressure control.
Neaton, J.D., Grimm, R.H., Prineas, R.J., Stamler, J., Grandits, G.A., Elmer, P.J., Cutler, J.A., Flack, J.M., Schoenberger, J.A., McDonald, R. and Lewis, C.E., 1993. Treatment of mild hypertension study: final results. Jama, 270(6), pp.713-724.
Opie LH, Seedat YK. Hypertension in sub-Saharan African populations. Circulation2005; 112(23): 3562–3568.

Parker, M., Puddey, I.B., Beilin, L.J. and Vandongen, R., 1990. Two-way factorial study of alcohol and salt restriction in treated hypertensive men. Hypertension, 16(4), pp.398-406.
Pickering, T., 1996. Recommendations for the use of home (self) and ambulatory blood pressure monitoring. American Journal of Hypertension, 9(1), pp.1-11.
Potter, J.F. and Beevers, D.G., 1984. Pressor effect of alcohol in hypertension. The Lancet, 323(8369), pp.119-122.

Poulter, N.R., Khaw, K.T., Hopwood, B.E.C., Mugambi, M., Peart, W.S., Rose, G. and Sever, P.S., 1990. The Kenyan Luo migration study: observations on the initiation of a rise in blood pressure. Bmj, 300(6730), pp.967-972.
Ryan, T.J., Anderson, J.L., Antman, E.M., Braniff, B.A., Brooks, N.H., Califf, R.M., Hillis, L.D., Hiratzka, L.F., Rapaport, E., Riegel, B.J. and Russell, R.O., 1996.ACC/AHA guidelines for the management of patients with acute myocardial infarction: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee on Management of Acute Myocardial Infarction). Journal of the American College of Cardiology, 28(5), pp.1328-1419.

Schnall, P.L., Schwartz, J.E., Landsbergis, P.A., Warren, K. and Pickering, T.G., 1992. Relation between job strain, alcohol, and ambulatory blood pressure. Hypertension, 19(5), pp.488-494.
Trilling, J.S. and Froom, J., 2000. The urgent need to improve hypertension care. Archives of Family Medicine, 9(9), pp.794-801.

Whelton, S.P., Chin, A., Xin, X. and He, J., 2002. Effect of aerobic exercise on blood pressure: a meta-analysis of randomized, controlled trials. In Database of Abstracts of Reviews of Effects (DARE): Quality-assessed Reviews [Internet]. Centre for Reviews and Dissemination (UK).
Xin, X., He, J., Frontini, M.G., Ogden, L.G., Motsamai, O.I. and Whelton, P.K., 2001. Effects of alcohol reduction on blood pressure: a meta-analysis of randomized controlled trials. Hypertension, 38(5), pp.1112-1117.1065.

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KEY FACTORS OF GLOBAL HEALTHCARE COST AND THEIR IMPACT

Author: : Uyapo Maweni

1. Department for Medical Laboratory Science, DDT College of Medicine.

2. Department of Medicine, DDT College of Medicine.

Corresponding Author Dr Derrick D. Tlhoiwe, Dr T Tlhoiwe, *Larry.L. Mweetwa*
Email: *journals@ddtcollegeofmedicine.com*

DDT College of Medicine,
P.O. Box 70587, Gaborone Botswana
Tel: +267(0)3904924/5
Cell: +267(0) 7710000
Fax: +267(0)3904935

Abstract|

Global health expenditure is rising worldwide, and the pace is most rapid in low- and middle-income countries where growth in all forms of spending (public, private and donor aid) is now averaging 6% annually as compared to 4% in high-income countries, according to a World Health Organization report (WHO 2018). This research paper is a systematic review that is based from different research articles and journals to explore impact of global healthcare cost, to evaluate key drivers of Global health care cost and to evaluate how global health care cost impact developing nations The research we are going to carry out is solely literature based, no participants or further interventions will be needed therefore study appraisal from an external Research

Ethics Committee won't be required. Information would be extracted from selected articles and the findings integrated into descriptive summaries. Results, limitations, conclusion and key findings will be drawn from the data analysis.

Key words| Healthcare, Global, Impact,

Background

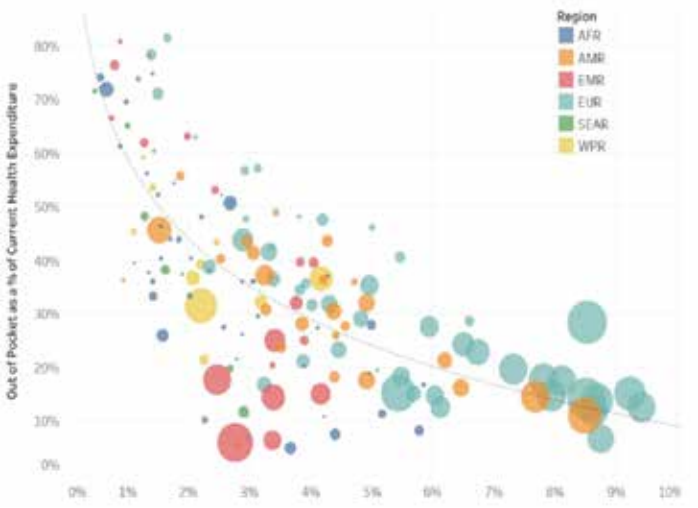
Global health care expenditures are expected to continue to rise as spending is projected to increase at an annual rate of 5.4 percent between 2017-2022, from USD $7.724 trillion to USD $10.059 trillion (WHO report 2018).

Data obtained from the WHO Global Health Expenditure Database (GHED) 2016 continues to show that health care cost expenditure is still on the rise in most countries. This data is supported and in agreement with findings from Health Policy Watch report 2019 which stated in low-income countries, public health spending remained stagnant as a proportion of gross domestic product (GDP) between 2000-2016, representing only 1.5% of GDP in 2016. In contrast, public health expenditures accounted for 6% of GDP in high income countries and over 3.5% of GDP in upper-middle income countries.
In developing countries, more attention is needed to prioritizing health in domestic budgets and to better exploiting economic growth to increase health spending as countries transition from external aid (Zhang, P., et al 2010). Less than 40% of

primary health care costs are funded by government or other domestic public sources in most developing countries, meaning that either donors or users have to pay out of pocket for many of the most basic health services essential to prevention and treatment of diseases, such as vaccines or maternal and new-born care (Martin, G., et al 2012). Inpatient and outpatient curative care and medicines also account for 70% of total global health spending, leaving little money, public or private, for prevention, which gets only about 12% of total spending and 11% of public funds (Kaboli, P.J., et al 2006).

Developing countries face a particular challenge in building up and expanding health systems organically so that they can absorb new sources of funds – so that increased donor aid can enhance, rather than "displace" of government finance sources (Health policy Watch report 2019).

Fig 1.1 below gives a summary of global health care cost as depicted from the WHO (GHED) July 6th 2019 report RESEARCH AIM



Impact of Personalised Medicine on Health Care Cost

The emergence of personalized medicine, exponential technologies, disruptive competitors, expanded delivery sites, and revamped payment models is injecting uncertainty into the global health economy and increasing the urgency for organizations to plan when and how to make future moves as a market leader, fast follower, or niche player to remain relevant and financially viable (Bonter, K.,et al 2011) Battling health system cost pressures Global health care expenditures continue to escalate, shining a light on health systems' need to reduce costs and increase efficiency(Poisal, J.A.,et al 2016). Spending is projected to increase at an annual rate of 5.4 percent in 2017–2022, from USD $7.724 trillion to USD $10.059 trillion (figure 3), although cost-containment efforts combined with faster economic growth should maintain the share of GDP devoted to health care at around 10.4 percent over the fiveyear period to 2022(Truffer, C.J.,et al 2019

1.1, Key drivers of global health care cost

Aging population and skyrocketing population growth

Similar with recent years, health care spending in 2019 will likely be driven by the shared factors of aging and growing populations, developing market expansion, clinical and technology advances, and rising labour costs. (Bodenheimer, T., 2005)In addition, the trend toward universal health care is expected to continue, with more countries expanding or deepening their public health care systems to reduce out-of pocket (OOP) expenses (StrandbergLR. et al 2015)

The short-term outlook for health care spending is expected to vary by region/ country: for example, population aging, rising wealth, and the expansion of China's health care system will likely drive increased spending in that country, as will the rollout of a new health insurance program such as in India and countries like Botswana embarking on medical aid(Young LY,et al 2011).• A recovery in global commodity prices appears to be helping to repair public finances and boost health care spending in many resource dependent countries; notably, in the Middle East, Latin America, and the former Soviet Union(Kidder SW.,et al 2003)

RESEACH AIM

To conduct a systematic review to assess key drivers of global health care cost and analyse their impact.

OBJECTIVES

1. To identify key drivers of Global health care cost.
2. To evaluate how global health care cost impact developing nations.

METHODOLOGY

In order to answer the aims and objectives of the research topic, secondary data was systematically reviewed. The databases used for attaining the information included PubMed, Google scholar. The utilization of the multiple databases presented the opportunity to gain accurate and reliable information that signified the primary aspects of the study. Also, the research study used the PRISMA tool for screening the research resources.

RESULTS

Identified studies were uploaded into endnote (Thomas Reuters) and duplicates were removed. 2 reviewers schemed through the study based on the topic and abstracts that met the inclusion criteria. Studies selected after the first screening were further screened through a detailed full text browsing, to further exclude studies that had some of the exclusion criteria. Out of 40 studies identified 30 were excluded due to year of publication. Out of the 10 selected, 5 were further excluded due to unsatisfactory results and conclusion. Only 5 were finally used.

Fig 1.0 | Prisma Flow Chart

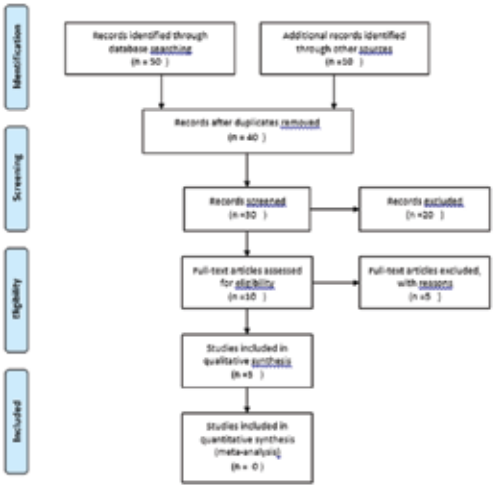


Fig 1.2| KEY RESULTS AND DISCUSSION

DATA ANALYSIS AND INTERPRETATION

Aging population

The rapid aging of populations around the world presents an extraordinary set of challenges. These challenges are ever-changing disease problems, increased spending on health and long-term care, labour force shortages, spending of excess amount saved, and potential problems with old-age income security. (Harper, S., et al 2014) Longer life spans, particularly longer healthy life spans, are viewed as a huge gain for human welfare. (Albert, J.,et al 1996.) The challenges come from the fact that current institutional and social arrangements are incompatible for aging populations and shifting demographics; the proposed solution is therefore to change the institutions and social arrangements. (Bloom, D.E., et al 2015.) Another challenge posed by population aging is the prospect of slower economic growth by way of slowing labour and lowering savings rates.

There are strong lifecycle patterns in work and saving, and older generations do not work and save as much as younger adults do. Reduced labour supply due to population aging may result in economies having to pay surplus back in the form of health care, long-term care, and capital de-accumulation as the elderly seek resources to finance their consumption in old age (Canning, D,. et al 2015).

Adults compose a larger proportion of the world's population than ever before a share that will only increase over the next century. The share of the population aged 60 and over is projected to increase in nearly every country in the world during the period 2005–50. Population ageing will tend to lower both labour force participation and savings rates, thereby raising concerns about a future slowing of economic growth. (Caldwell, John C., et al 2002). ,

Population growth

Every year health care expenditures increased considerably due to population growth. Although policy makers can do practically nothing to affect this situation, it is important that they understand and anticipate the economic impact of such demographic changes. Population growth on spending in the hospital, physician, and nursing home sectors is increasing the costs of provision of free healthcare as well as other personal" health care spending, this includes dental care, other health professionals, drugs and medical sundries

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Life Span

Increasing life spans and years of productive life is a major achievement for health care, because increased output per worker is associated with increased real GDP per capital. Life span appears to continue to rise remarkably. It is anticipated to increase from 73.5 years in 2018 to 74.4 in 2022 bringing the number of people aged over 65 globally to more than 668 million, or 11.6% of the total global population. (Feldstein, M and Horst,S. 2002.).

Linking data on medical care expenditures to estimate life span for persons 70 years of age in various health states, we estimated the relations among health, longevity, and expected health care spending. (Spillman BC, Lubitz J., 2000) .Analysis shows not only that persons in good health at 70 years of age can expect to live longer and to have more years of good health than those in poor health at age 70, but also that their total expected medical care expenses appear to be no greater than those for less healthy persons, even though healthier persons live longer(Miller, T., 2001).Lower annual expenditures from the age of 70 until death among healthier persons offset the greater time they have to accumulate health care costs .(Schoeni, RF,. et al 2001)

Communicable diseases

The number of AIDS-related deaths dropped from 2.3 million in 2005 to an estimated 940,000 in 2017, largely due to the successful rollout of treatment. Infections from tuberculosis are falling by around 2% a year. (WHO reports 2018).The estimated number of malaria deaths worldwide fell to 445,000 in 2016, down from nearly one million in 2000. New vaccines and wider use of treated nets have cut infection and death rates for all mosquito-borne diseases. (WHO report 2018)

Hygiene

The fight for improved Global Healthcare through better sanitation, improved living conditions and wider access to health care is making prominent gains. (WHO report 2007)

The world is expected to fall short of meeting the drinking water Millennium Development Goal (MDG) target by 354 million people and the sanitation MDG target by 564 million people. Recently it was estimated that 1.7 million deaths per year were attributable to unsafe water supply, sanitation and hygiene.(World Health Organization, 2007) A variety of economic impacts are linked to improved water and sanitation, which is one key contributor to poverty reduction efforts. Based on trends from 1990 to 2004, these countries are predicted to fall short of one or both of the MDG targets for water supply and sanitation. (World Health Organization, 2007) Therefore the information reveals the impacts of low cost water supply and sanitation improvements in countries where the predicted coverage in 2015 falls short of the water supply and sanitation MDG targets, with the aim of focusing existing budgets as well as new resource allocations on the achievement of the Millennium Development Goal targets in these off-track countries .Economic benefits are estimated to total US$ 38 billion annually for meeting the combined water and sanitation MDG targets. 92% of this value is accounted for by achieving the sanitation MDG target. Sub-Saharan Africa accounts for 41% of the global economic benefit, given that a significant proportion of the off-track countries are in Africa. (World Health Organization2007)

Economic benefits of sanitation are more heavily dominated by convenience time savings at 90% of the total economic benefit, followed by 8% to productivity gains, and 2% to health care cost savings. (World Health Organization, 2007)

Non-communicable diseases (NCDs) most prominently, cancer, heart disease, and diabetes accounted for 71% of the 56.9 million deaths reported worldwide in 2016; that share increases to over 80% in the most developed markets (Kang S., et al 2012). NCDs' rise in both developed and developing markets is fuelled by urbanization, sedentary lifestyles, changing diets, and rising obesity levels (Kang S., et al 2012).

Non-communicable diseases

The impact of non-communicable diseases (NCDs) in populations extends beyond illhealth and mortality with large financial consequences. Healthcare expenditure for cardiovascular disease (12–16.5 %) was the highest; other NCDs ranged between 0.7 and 7.4 %(Macafee DA., et al 2009). NCD-related health costs vary across the countries, regions, and according to type of NCD. Additionally, there is an increase in costs with increased severity and years lived with the disease (Macafee DA., et al 2009).

CONCLUSION

Botswana and other sub-Saharan countries are faced with serious financial constraints which limits them to archive universal coverage in some parts of the country, for example in the late 80's southern Africa suffered massive loss of people dying of HIV&AIDS because treatment was not affordable, this is still a challenge of other African countries. Global healthcare expenditure can be estimated using its key drivers, which in this case will focus on just 6 key drives which are namely: hygiene, aging population, population growth, life span, non –communicable disease/communicable disease, demographic factors and it is important to make sure these factors are carefully taken into consideration as they play a major role in the health sector.

Rapid population aging is the contributory key driver of healthcare cost and it is accompanied by several distinctive challenges in health, labour supply, and financial constraints due to resources dedicated towards taking care of the elderly.

Countries with rapidly aging populations may find themselves with a growing disease burden on their hands: nearly one quarter of the world's burden of disease is attributable to illness in adults aged sixty and over. An increase in longer life spans results in lifestyle associated chronic diseases such as diabetes and hypertension which are very expensive to treat for a life time.

Developing countries try by all means to provide affordable healthcare service and also subsidy prices of healthcare services as a way to enable access to health services.

This systematic review will aid in knowledge and help in development of new policies that will help in regulating or lowering down healthcare cost in Botswana and other sub-Saharan countries as its kind has never being carried out, because they was limited information in Botswana and other countries when formulating this systematic review.

REFERENCES

Bloom, D.E., Canning, D. and Lubet, A., 2015. Global population aging: Facts, challenges, solutions & perspectives. Daedalus, 144(2), pp.80-92.Abrahams, E., Ginsburg, G.S. and Silver, M., 2005. The personalized medicine coalition. American Journal of Pharmacogenomics, 5(6), pp.345-355.

Cairncross, S. and Valdmanis, V., 2006. Water supply, sanitation and hygiene promotion (Chapter 41).

Caldwell, John C., Pat Caldwell, and Peter McDonald. 2002. "Policy responses to low fertility and its consequences: A global survey," Journal of Population Research 19(1): 1–24.

Calnan, M., Cant, S. and Gabe, J. (1993), Going Private: Why People Pay for their Health Care, Oxford: Oxford University Press.

Disney, Richard and Paul Johnson. 2001. "An overview," in Richard Disney and Paul John
Dixon S, McDonald S, Roberts, J.2001.AIDS and economic growth in Africa: a panel data analysis.-JIntDev; 13:411-26.

Feldstein, Martin and Horst Siebert. 2002. Social Security Pension Reform in Europe. Chicago

Harper, S., 2014. Economic and social implications of aging
Kang S, Koh ES, Vinod SK, Jalaludin B. 2012 Cost analysis of lung cancer management in South Western Sydney. J Med Imaging Radiat Oncol.; 56(2):235–41. doi:10.1111/j.1754-9485.2012.02354.x.
Low JJ, Ko Y, Ilancheran A, Zhang XH, Singhal PK, Tay SK. 2012 Health and economic burden of HPV-related diseases in Singapore.Asian Pac J Cancer Prev.;13(1):305–8. doi:10.7314/apjcp.2012.13.1.305.

Macafee DA, West J, Scholefield JH, Whynes DK., 2009; Hospital costs of colorectal cancer care. Clin Med Oncol. 3:27–37.
24(2):461–8.

Miller T. 2001.Increasing longevity and Medicare expenditures.
Schoeni RF, Freedman VA, Wallace RB. 2001. Persistent, consistent, widespread, and robust? Another look at recent trends in old-age disability. J

Spillman BC, Lubitz J. 2000. The effect of longevity on spending for acute and long-term care. N Engl J Med;342:1409-1415

WHO,Global Health Expenditure Database Report ,2014

World Bank. Health expenditure per capita (current US$). World Health Organization Global Health Expenditure database 2016; Available from: http://data.worldbank.org/indicator/SH.XPD.PCAP
World Health Organisation. Research for universal health coverage. The world health report 2013. 2013.

World Health Organization, 2007. Economic and health effects of increasing coverage of low cost household drinking-water supply and sanitation interventions to countries off-track to meet MDG target 10: background
document to the" Human Development Report 2006" (No.

WHO/SDE/WSH/07.05). Geneva: World Health Organization.
World Industry Outlook, Healthcare and Pharmaceuticals, The Economic

A Systematic Review of the Role of Physiotherapy Interventions in Palliative Care

Author: : Dr Derrick D. Tlhoiwe, Dr L. Phokontsi, Dr L. Mweetwa, Dr T. Tlhoiwe, Muya, C.K.; Mudawarima, T. Silumesii, L. Chisenge

1. Department of Physiotherapy and rehabilitation Sciences
2. Department of Pharmacy and Pharmaceutical Sciences

Email: *journals@ddtcollegeogofmedicine.com*

DDT College of Medicine,
P.O. Box 70587, Gaborone Botswana
Tel: +267(0)3904924/5
Cell: +267(0) 7710000
Fax: +267(0)3904935

Abstract

The aim of this research is to conduct a systematic review analysing the role of the physiotherapy interventions in palliative care. PRISMA as a critical appraisal tool was utilised for the selection of the research articles. The inclusion criteria were based on the year of publication, ease of availability, language, geographical location, and study type. To ensure the credibility, databases such as Elsevier, Proquest, and EBSCO Host were used to filter the grey content. Data published in the past ten years (2009-onwards) was only included to ensure the selection of the most recent interventions used by the physiotherapists. A total of 11 articles were selected which determined that physiotherapy interventions involving breathing exercises, aerobic exercises, manual therapies, and educational awareness were critical to promoting the functional capability and empower the patients.

Keywords: Physiotherapist, Palliative Care, Physical Therapy, End-of-Life Care, Non-pharmacological Intervention

Background

World Health Organisation (WHO) defined palliative care as the approach which enhances the quality of life of the patients who are encountered with life-threatening diseases through the management and relief from the suffering through early intervention, impeccable evaluation, and treatment of pain and other associated issues [1]. Patients in palliative care experience a greater level of functional incapability and disability as a result of disease progression, direct local and systematic impacts, and deconditioning pain. Impairment in physical functioning is a predominant contributor to a significant decline in the quality of life of such patients. Palliative care patients expressed a high desire to stay physically active during the course of the disease while sustaining and retaining physical independence [2]. Thus, the notion of rehabilitation in palliative care Spatients is to promote adequate treatment provided with the objective to eradicate disability through optimising the functional status, independence, autonomy, and standard of living.

The World Confederation for the Physical Therapy has defined physical therapy or physiotherapy as the provision of services to the people for the development, maintaining, and restoring the maximum mobility as well as functional capability throughout the entire life-span [3]. Physiotherapy, in particular, encompasses the services in situations where the function and the movement are threatened by the ageing process or due to any injury/disease [4]. Physiotherapists form an integral component of the multidisciplinary team (MDT) in the palliative care by focusing on the processes and procedures for enhancing the function and quality of life through multivariate care dimensions [5]. Of these care dimensions, the physical dimension in the palliative care treatment and management is linked to symptom control, improving the flexibility, mobility, endurance, deformity, gait, balance, co-ordination, deformity, energy expenditure, and exercise tolerance along with maintaining adequate breathing. The functional dimensions, on the other hand, are related to improving the daily activities and functions that include the sensorimotor performance [6]. Physiotherapists aim to improve the successful performance of the complicated physical functional activities such as housekeeping and maintaining personal hygiene which requires the involvement of the affective and cognitive abilities.

The integration of physiotherapists into the palliative care plan is a relatively new concept despite the fact that the physiotherapy interventions in palliative management were identified during the early 1960s [1]. The primary objective of including a rehabilitation approach while treating the palliative care patients is through goal setting to enhance the functional ability while subsequently reducing the disease consequences as long as possible [7]. The ultimate goal of the physiotherapist is to promote independence as much as possible to ensure the accomplishment of important activities to ease the end-stage life of the people. However, in cases where improving the functional ability is not possible, physiotherapy intervention is to promote the patient as well as the ability of the carer to cope with the deteriorating condition of the patient through awareness and education to improve the quality of life [8]. Therefore, the overall aim of the physiotherapist is to facilitate the patient to reach the best possible quality of living for the remaining patient's life.

Methodology

Research Design

The research design for this study has been based on the systematic review of the literature to determine the interventions of physiotherapists in palliative care. Through a systematic review, the selection of the appropriate data sources enabled the researcher in collecting pertinent, credible, and reliable information through the use of databases for the selection of peer-reviewed journal articles [9]. Provided the nature and phenomenon of the research topic, systematic qualitative review of literature is optimal as it enables in determining the interventions of physiotherapists from previous authenticated researches without the involvement of any statistical testing as no variables are involved in this research.

Search Strategy

The search strategy for the attainment of the most desirable information comprised on the use of the keywords "Physiotherapy", "Physiotherapist" "Physiotherapy interventions", and "Palliative care" alone as well as in combination with the utilisation of the Boolean Operators "AND" and "OR". The Boolean Operators were incorporated into the search strategy of the most reliable, authenticated, and prominent databases in the field of health sciences which included Elsevier, ProQuest and EBSCO Host. Here, it is important to signify that the entire research was constituted using the widely used and openly accessed databases to ensure the reproducibility and credibility of the literature.

Data Extraction

The criterion for the extraction of data was based on the inclusion versus the exclusion criteria. The inclusion criteria facilitate in setting the boundaries and restrictions for collecting the most viable, authenticated, and reliable information [10]. Different approaches for the inclusion criteria which had been specified for this research included the language, publication year, study type, geographical aspects, design of the research, and the interest exposure. In the regard, through the use of the inclusion criteria, the researches which had been published in the English language only were opted while literature in a language other than English was excluded. In a similar manner, the research studies which had been published in the last ten years were selected for this study to ensure the inclusion of the most updated and relevant context. Thus, literature published before 2009 was excluded from the selection.

Selection of the Study

The selection of the study in the systematic approach is regarded as the critical appraisal which ensures the value and trustworthiness of the study. Critical appraisal is commonly regarded as the implications of the values and rules that predominantly assist in the evaluation of the resulting viability, method, and procedures while adhering to the ethics. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) are used for the assessment of the critical appraisal tool for determining the validity and reliability of the data collection [11]. PRISMA promotes in easy filtration of the research articles to comply with the standards of the quality. Thestep-by-step assessment of the PRISMA to determine the physiotherapy intervention in palliative care is illustrated in the following figure below [5]

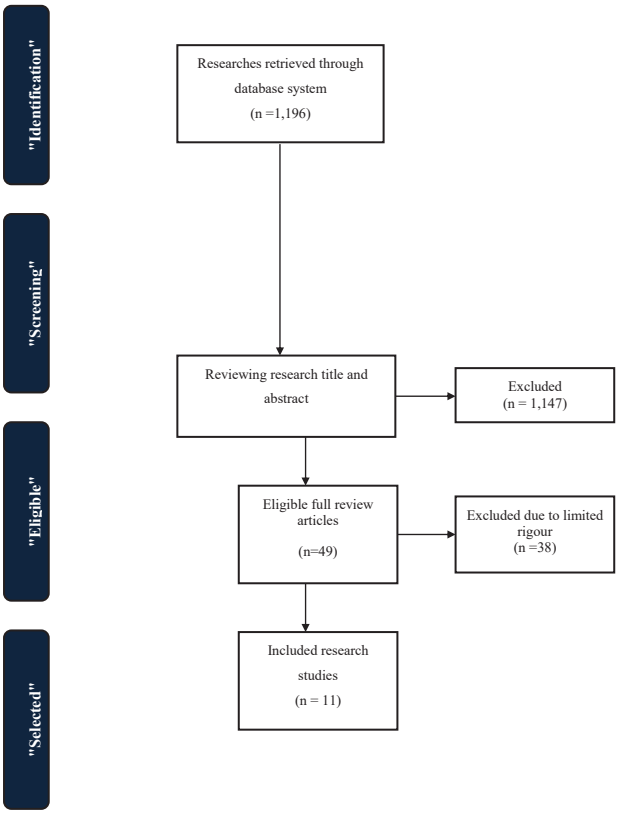

Fig 1| PRISMA Flow Diagram

Hegarty et al.	2016	Ireland	Cross-sectional Study	The key findings indicated that physiotherapy induced palliative exercising interventions in patients suffering from Parkinson's disease improved the strength of the lower limbs. The physiotherapist intervention specifically deduced that palliative exercising could serve as a potential modification for the accomplishment of clinically relevant results in the walking ability of the patients.
Lim and Ng	2015	Singapore	Mixed methodology	It was determined that improving the knowledge and skills of the physiotherapists through perception and knowledge in the palliative care domain could predominantly assist in analysing the challenges in acute hospital settings. Good palliative care is dependent on effective communication, education and advice, so physiotherapist intervention is based on developing communication skills to improve technical competencies.
Möller et al.	2016	Sweden	Pilot Study	Physiotherapist interventions in palliative care settings were determined through multiple therapeutic mechanisms focused on patient-centric needs, good diagnosis, promotion of physical activity, treatment plans. The pilot study determined that a better-nuanced investigation of the clinical complications could facilitate in the optimisation, clarification, and development of physiotherapy interventions.
Jensen et al.	2014	Germany	Retrospective, Descriptive Study	The key analysis indicated that physical exercise in advanced cancer patients had a beneficial impact on the mobility and functional ability with respect to the disease-related and socio-demographic aspects. Physiotherapeutic intervention including the relaxation and the breathing therapies improved the quality of living of terminally ill patients.
Przedborska et al.	2015	Poland	Quantitative Method	The findings indicated that though physiotherapy interventions did not exhibit a statistically significant relationship in enhancing the self-care and mobility of the

				patients in palliative care, however, prominent results were recorded in the management of the depression, anxiety, and intensity of dyspnea after the physiotherapy program. Walk retraining, education and advice on health as well promotion of physical activity.
Morrow et al.	2017	South Africa	Cross-sectional Descriptive Survey	Despite inadequate training, knowledge, and required skillsets, a large number of physiotherapists were able to manage the critical requirements of the patients during palliative care and thus proper inclusion of the palliative care knowledge in the graduate program could yield better and positive outcomes for optimising the individual functional capability.
Saher et al.	2018	India	Randomised Clinical Trial Retrospective Study	The final outcomes indicated that physiotherapists led interventions improved the functional capability while offering relief from the symptoms to the patients in palliative care. This signified the notion that physiotherapists in caring of patients could enhance the independence and quality of living during end-stage of life.
Cullum	2019	United Kingdom	Qualitative Semi-structured Interviews	Within the inpatient settings, rehabilitative palliative care has become a challenge for the inpatient hospice unit and physiotherapist could play an integral role in eradicating the barriers through effective communication and rehabilitative palliative care practices while improving the confidence and autonomy of the patients.
Wilson and Briggs	2017	United States of America	Review Article	Lack of the consistent integration of the physiotherapist within the hospital settings is constituted as a barrier in the provision of non-opioid alternatives for the management during the palliative care. Physical therapy supports pain management by improving the quality of life and reducing the dependency on opioid medication.
Pullen et al.	2014	Nigeria	Case Study Analysis	The key analysis interpreted a complete eradication of the shortness of breath (SOB) upon exertion and relief from pain due to the physiotherapy sessions. In addition, a prominent reduction was also observed in muscle endurance, strength, and resting heart rate. Hence, the physiotherapy interventions comprising of

				manual therapy and exercise were beneficial as an adjunct therapy.
Pyszora et al.	2017	Poland	Randomised Clinical Trial	Exercising program design led to a prominent decrease in the fatigue scores within the palliative care which positively influenced the day-to-day functioning. These findings led to the belief that physiotherapy is regarded as an effective and safe method in cancer-related fatigue to improve the quality of living.

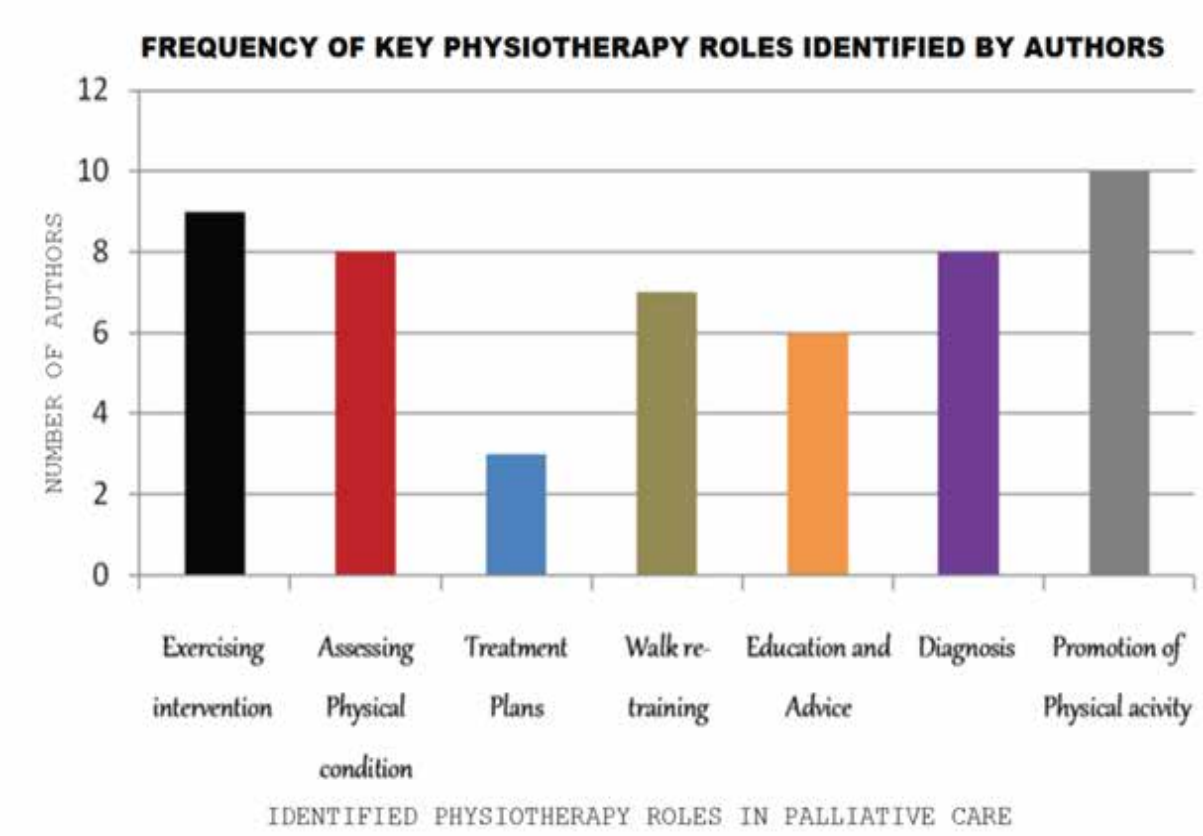

Fig 2 I Key Physiotherapy roles identified

Discussion

The data analysis has offered a comprehensive evaluation highlighting the contemporary role of the physiotherapist interventions in the treatment and management of palliative care, among key roles frequently identified was promotion of physical activity, exercise intervention, diagnosis and assessing physical condition, walk-retraining, education and advice and developing treatment plans in line with client need as well as involvement. Palliative care is regarded as a holistic practice which involves caring of the people living with life-threatening illnesses or individuals during the end stage of the lives. Though pharmacological interventions are the primary source to manage and treat the palliative care measures, exercise and the physical activity acts as a secondary mechanism to improve the quality of living thereby acting as a cornerstone to the non-pharmacological management [12]. In this context, a physiotherapist led palliative exercise programme (PEP-PD) was designed which was executed for a total of six weeks duration constituting of portable ankle weights. The outcomes of the study clearly signified that a progressive six-week physical therapy improved the muscle strength and intensity of the lower limbs in patients living with Parkinson's disease (PD).

Nonetheless, the improvement in the flexibility and strength did not incur any difference in the severity of the patient condition. Similarly, physiotherapy leads to the maximisation of mobility, independence, and mobility provided adequate treatment and monitoring [13]. In this regard, improving the attitude, knowledge, experience, and beliefs of the physiotherapists to improve the standard and quality of life for the patients in palliative care is important [14]. Hence, physiotherapy-led interventions are integral in promoting individual autonomy, independence, mobility, and body functioning during the end of life care.

Other physiotherapy interventions included the strengthening exercises offered to patients determined that physiotherapy has a positive and direct relationship in improving the patient outcomes and perceived well-being in populations demanding palliative care [15, 21].

Despite the fact that the profession has been under-valued and underestimated across the globe, there is a growing impetus for the improved physiotherapist's interventions and involvements in the in-patient as well as outpatient settings to offer relief from symptom and pain through non-pharmacological interventions. Specific physiotherapy interventions included breathing/aerobic exercises which are beneficial and recommended during the advanced disease progression to offer timely relief to the patients. Physiotherapy leads to a significant reduction in the rate of fatigue in patients receiving palliative care [16, 24].

Physiotherapy interventions are beneficial in the symptom management and alleviation of troublesome pain and discomfort through increased mobility and focusing on physical activity. Additionally, physiotherapy interventions in advanced diseases play a crucial role in improving the overall state of well-being of the patient while subsequently limiting the severity of the comorbid symptoms [17]. Hence, aerobic exercising, awareness, education, and alteration in the breathing mechanisms through physiotherapy interventions could play a positive role in improving the general state of the patients receiving palliative care.

Another physiotherapy intervention is based on generating awareness and improving the educational needs of the patients and the carers. Lim and Ng focused on the effectiveness and importance of the educational needs of the physiotherapists in the domain of palliative care [18, 23]. A lack of confidence and knowledge could lead to a negative influence on the quality of care services thereby affecting the patient well-being receiving palliative care. As opposed, good palliative care is highly dependent on effective communication skills as well as the technical competencies of the physiotherapists. In addition, multivariate role of the physiotherapists is involved in the specialised palliative care through prioritising the patient needs and addressing the emergent issues which directly hamper in the sudden alterations in the health status of the patients [19]. Therefore, educating the patient and creating awareness among the caregivers is also identified as a critical intervention through which the quality of life and well-being of the patients receiving palliative care could be addressed.

Along with educating the patients, education and development of the skillset of the physiotherapists are equally important in developing effective communication and interpersonal therapeutic relationships to provide ease and independence during the last stages of life.

Kumar and Jim (2010) discussed different physical therapy techniques and interventions comprising of therapeutic exercise, electrical modalities, thermal modalities, additional physical agents, and miscellaneous modalities (manual therapies) which offer an inherent role in improving the functional ability and care dimensions during the palliative care. The therapeutic exercises constituted of assisted active movement for offering relaxation, stabilisation, and mobilisation.

Electrical modalities, on the other hand, included the neuromuscular electrical stimulation which has been regarded as useful specifically in pain relief and management. Thermal modalities included the utilisation of heating and cold packs to promote flexibility. Physiotherapists play integral part in the multidisciplinary team involved with patients receiving palliative care [20]. This is done through physical therapy interventions which improve flexibility, muscle strength, durability, and functional mobility, as well as through optimising the respiratory, circulatory, cardiac, and muscular functioning to control pain and improve the functional independence [22]. Thus, physical therapy in palliative care patients is significant in promoting physical strength and independence.

Conclusion

The aim of this research study was to evaluate the role of the physiotherapist intervention in palliative care through critical analysis of the past literature. This systematic review of literature facilitated in analysing different intervention techniques which are globally utilised by physiotherapists for improving the quality of life during the end-stage of the patients. The analysis of the 11 research articles published in a period of ten years (2009 onwards) has identified multivariate intervention techniques which are adopted by the physiotherapists to enhance the general well-being through functional mobility, independence, and educational awareness. The findings also emphasised on the active role of the physiotherapists in pain relief and improvement in the symptoms through non-pharmacological techniques which lead to better outcomes for the patients. Hence, it is subjugated that involvement of the physiotherapists in the multidisciplinary team designed for patients receiving palliative care is essential in improving the physical strength, independence, and autonomy of the patients through optimised control mechanisms.

References

1. Saher, T.; Kalra, S.; Yadav, J.; Thariwal, S.; Yadav, K.; Tanwar, P. Role and importance of Physiotherapy during Palliative Care in India: A Review. World Journal of Research and Review 2018, 7(4), 01-08.
2. Montagnini, M.; Lodhi, M.; Born, W. The Utilization of Physical Therapy in a Palliative Care Unit. Journal of Palliative Medicine 2003, 6 (1), 11–17, doi:10.1089/10966210360510073.
3. What is physical therapy. https://www.wcpt.org/what-is-physical-therapy (accessed Apr 22, 2020).
4. Kumar, S.; Jim, A. Physical Therapy in Palliative Care: From Symptom Control to Quality of Life: A Critical Review. Indian Journal of Palliative Care 2010, 16 (3), 174, doi:10.4103/0973-1075.73670.
5. Guide to Physical Therapist Practice. Physical Therapy 2001, 81 (1), 9.
6. Jette, A. M. Physical Disablement Concepts for Physical Therapy Research and Practice. Physical Therapy 2010, 74 (5), 380–386, doi: 10.1093/ptj/74.5.380.
7. Marcant, D.; Rapin, C.-H. Role of the Physiotherapist in Palliative Care. Journal of Pain and Symptom Management 1993, 8 (2), 68–71, doi:10.1016/0885-3924(93)90102-2.
8. Peter, M.; Ann, C.; Sam, P.; Jacqui, S.; Dai, R.; Andrew, L.; Chris, T.; Ann, C. Complementary Therapists Motivation to Work in Cancer/Supportive and Palliative Care: A Multi-Centre Case Study. Complementary Therapies in Clinical Practice 2009, 15 (3), 161–165, doi:10.1016/j.ctcp.2009.03.004.
9. Jackson, S. L. Research methods and statistics a critical thinking approach; Wadsworth Cengage Learning: Australia, 2016.
10. Salkind, N. J. Encyclopedia of research design; SAGE reference: Los Angeles, 2010.
11. Linsley, P.; Kane, R.; Barker, J.H. Evidence-based practice for nurses and healthcare professionals; Sage Publications: S.l., 2019.
12. Hegarty, D.; Galvin, R.; McGirr, L.; Cahill, F.; McQuillan, R.. Physiotherapy led palliative exercise programme for people with advanced Parkinson's disease (PEP-PD): A feasibility study. Physiotherapy Practice and Research, 2015, 37(1), 31-39, doi:10.3233/ppr-150070.
13. Tomlinson, C. L.; Herd, C.P.; Clarke, C.E.; Meek, C.; Patel, S.; Stowe, R.; Deane, K.H.; Shah, L.; Sackley, C.M.; Wheatley, K.; Ives, N. Physiotherapy for Parkinson's disease: a comparison of techniques. Cochrane Database of Systematic Reviews 2014, (6).
14. Morrow, B. M.; Barnard, C.; Luhlaza, Z.; Naidoo, K.; Pitt, S. Knowledge, Attitudes, Beliefs and Experience of Palliative Care amongst South African Physiotherapists. South African Journal of Physiotherapy 2017, 73 (1), doi:10.4102/sajp.v73i1.384.
15. Jensen, W.; Bialy, L.; Ketels, G.; Baumann, F. T.; Bokemeyer, C.; Oechsle, K. Physical Exercise and Therapy in Terminally Ill Cancer Patients: a Retrospective Feasibility Analysis. Supportive Care in Cancer 2013, 22 (5), 1261–1268, doi:10.1007/s00520-013-2080-4.
16. Przedborska, A.; Misztal, M.; Wroński, M.; Gruziel, D.; Świątczak, M.; Ciałkowska-Rysz, A. Raczkowski, J.W. The effect of physiotherapy on the condition of cancer patients receiving palliative care. Medycyna Paliatywna/Palliative Medicine 2016. 8(2), 68-74.
17. Kaur, D.; Kumar, G.; Billore, N.; Singh, A. Defining the Role of Physiotherapy in Palliative Care in Multiple Sclerosis. Indian Journal of Palliative Care 2016, 22 (2), 176, doi:10.4103/0973-1075.179599.
18. Lim, J.; Ng, K. Educational Needs of Physiotherapists in the Area of Palliative Care: a Multi-Centre Study in Singapore. Physiotherapy 2015, 101, e875–e876, doi:10.1016/j.physio.2015.03.1704.
19. Möller, U. O.; Malmström, M.; Beck, I.; Rasmussen, B. The Variability of Physiotherapeutic Interventions in Specialized Palliative Care. Physiotherapy 2016, 102, e92–e93, doi:10.1016/j.physio.2016.10.094.
20. Laakso, L. The role of physiotherapy in palliative care. Australian family physician, 2006. 35(10), 781.
21. Wilson, C. M.; Briggs, R. Physical Therapys Role in Opioid Use and Management During Palliative and Hospice Care. Physical Therapy 2017, 98 (2), 83–85, doi:10.1093/ptj/pzx108.
22. Pyszora, A.; Budzyński, J.; Wójcik, A.; Prokop, A.; Krajnik, M. Physiotherapy Programme Reduces Fatigue in Patients with Advanced Cancer Receiving Palliative Care: Randomized Controlled Trial. Supportive Care in Cancer 2017, 25 (9), 2899–2908, doi:10.1007/s00520-017-3742-4.
23. Pullen, S.; Chigbo, N.; Chukwudi, N. E.; Chim, A. C.; Chinwe, C.; Chukwunoso, I. S. Physiotherapy Intervention as a Complementary Treatment for People Living with HIV/AIDS. HIV/AIDS - Research and Palliative Care 2014, 99, doi:10.2147/hiv.s62121.
24. Cullum, S. Rehabilitative Palliative Care - a Challenge on the Hospice Inpatient Unit? Physiotherapy 2019, 105, e167–e168, doi:10.1016/j.physio.2018.11.172.

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DDT COM ACADEMIC DATES

12th-13th	January	Supplementary Exams
13th-14th	May	Registration
26th-27th	August	Registration
14th-15th	January	Registration
17th	May	Classes begin
30th	August	Classes begin
18th	January	Classes Begin
31st	May-3rd June	QUIZ 1
13th-17th	September	QUIZ 1
1st-4th	february	QUIZ 1
21st-25th	June	Midterm Exam
11th-15th	November	Midterm Exam
1st-4th	March	Mid term Exam
12th-16th	July	QUIZ 2
18th	November	Graduation
22nd -26th	March	Quiz 2
09th-13th	August	Final Exam
1st-5th	November	QUIZ 2
26th-30th	April	Final Exam
16th-20th	August	Orientation
29th	Nov-3rd Dec	Final Exam
20th	Decembe	College closes

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Jan 2nd	New year Holiday Day
Feb 14th	Valentine's Day
Apr 10th	Good Friday
Apr 13nd	Easter Monday
May 1st	Labor Day
May 21st	Ascension Day
Jul 1	Sir Seretse Khama Day Holiday
Jul 20th	President Day
Jul 21st	President Day
Sep 30th	Independence Day
Oct 1st	Holiday
Dec 25th	Christmas
Dec 26th	Boxing day

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