Risks in Medical Device Vigilance

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DEDICATION

To my parents and grandparents,

whose courage (*kaisog*) and resilience (*kabakod*)

gave me a chance for a better life.

To Shaklee my sister and soulmate,

who saw me through everything.

"Kag para sa lamharon ko nga kaugalingon,

nga ang mga handom kay mas malapad pa sa bilog nga kalangitan."

And to my younger self, whose dreams were bigger than the whole sky.

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ABSTRACT

Medical devices include a variety of products ranging from simple bandages to artificial bones. Intensive safety measures are adopted from the approval up to release of the medical device to the market. The aims of the study were to 1) evaluate perspectives of end-users with medical device incident reporting, 2) assess and develop a database for medical device Compliance Exchange Form (CEF) received by the medical device directorate which contains medical device inquiries from Competent Authorities and Designating Authorities within the European Union, 3) assess procedures used by a competent authority in handling incident reports, and 4) develop a risk management plan for risk mitigation**.** The study employed a qualitative approach in which Phase 1 is literature analysis of end-users' perspective with medical devices. Phase 2 dealt with the evaluation of Compliance Exchange Form received by the competent authority from 2021 to 2022 through a developed database. Phase 3 involved a gap analysis of the current Standard Operating Procedures (SOP) of a competent authority through a focus group discussion with three members representing the medical device directorate of the competent authority, and Phase 4 was the development of a risk management plan and pilot implementation. The study results were: Phase 1: From the literature review, eight barriers of underreporting in medical devices were found: Lack of awareness in reporting, workload and time constraints, incident was deemed non-reportable, perception of consequence, lack of reporting system, non-reporting culture, failure to recognise incident and blame culture. Phase 2: The assessment of the CEF showed that Malta participated and responded to six CEFs out of nine CEFs received. The CEF database showed differences in the number of initiated CEFs within EU member states which can be attributed to the accessibility and digitalisation of reporting systems. Phase 3: The three representatives of the focus group discussion identified that 1) the present SOP is

adequate for operations in Malta, 2) direct communication with stakeholders improved quality of investigation, 3) triage system in receiving reports needed further development, and 4) plans for information dissemination to reduce underreporting are in place. Phase 4: A risk management plan was developed and the pilot implementation with an assessor from the medical device directorate was done. A risk score using the risk matrix was identified for each incident report and corresponding action plan was recommended for risk reduction. The incorporation of the risk management plan to the SOP of the medical device directorate contributes to the continuous efforts of medical device vigilance. Harmonisation of incident reporting and assessment of lack of reporting are recommended. Strengthening the medical device vigilance leads to improved safety of patients and medical device users.

Keywords: medical devices, vigilance, risk management plan, risk assessment, vigilance risks

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LIST OF ABBREVIATIONS

ADR	Adverse Drug Reaction
AE	Adverse Event
CA	Competent Authority
CE	Conformité Européenne or European Conformity
CEF	Compliance Exchange Form
CENELEC	European Committee for Electrotechnical Standardisation
CEN	European Committee for Standardisation
EC	European Commission
EEA	European Economic Area
EMA	European Medicines Agency
ERMS	European Risk Management Strategy
EU	European Union
EUDAMED	European Database on Medical Devices
FSCA	Field Safety Corrective Action
GVP	Good Pharmacovigilance Practice
IEC	International Electrotechnical Commission
IFU	Instruction for Use

IRB	Institutional for Review Board
ISO	International Organisation for Standardisation
JAMS	Joint Action on Market Surveillance of Medical Devices
MD	Medical Device
MDPC	Medical Devices and Pharmaceutical Collaboration
MDR	Medical Devices Regulation
MHRA	Medicines and Healthcare products Regulatory Agency
MIR	Manufacturer Incident Reports
MMA	Malta Medicines Authority
NA	National Authority
NB	Notified Bodies
NCA	National Competent Authority
NHS	National Health Service
RMP	Risk Management Plan
SOP	Standard Operating Procedure
TGA	Therapeutic Goods Administration
UDI	Unique Device Identifier
US FDA	United States Food and Drug Administration

Chapter 1

INTRODUCTION

1.1 Background

Medical device vigilance is demonstrating and running a system that collects and reports data regarding incidents from medical device use. Protocols such as product intake, evaluation, process, and adverse-effect reporting are included in the vigilance system where risks may be present and pose a threat to the operation and safety of its users. The setting up of medical device vigilance points to risk minimisation and overall safety for end-users, healthcare professionals, and the general public. Vigilance and reporting in medicines are different from that of medical devices but there are a number of lessons to be derived or applied from one to the other. For example, both medicines and medical devices encounter vigilance similar risks including issues with reporting incidents, incomplete collection of data, delays in investigation, and errors in recall processes. In both areas, prevention and minimisation of these risks are vital in maintaining and ensuring patient safety.

1.2 Risk

The word ‘risk’ can be traced back to the Italian translation 'risicare' meaning to dare. The word represents courageous acts towards new and unknown things and situations that can be considered of choice. Risk does not only revolve around being positive or negative but it goes beyond the measure of certainty of how things will eventually turn out. Probability can be mathematically interpreted as greater than zero and less than one which mirrors the binary language. Zero signifies the likelihood of the incident not happening and one signifies the incident as most likely happening. Probability, then, introduces the field of inducing rational assumptions about uncertainty and the likelihood of certain risks. Depending on the end goal and case, risk does not only account for the occurrence of incident but also the agreeableness of the incident towards the final point. The most

interesting part of the risk is that it is linked with time through the unmasking of events. Risk, and its indivisible link to time, pilots the direction of risk as an event that is future-oriented, implying that outcomes may or may not materialise in the uncertain future (Bernstein, 1996; Rasborg, 2021).

Modernity has prompted the desire to manipulate risk which is a departure from the original belief system of man that is governed by Providence, luck, fate, and rigid outcomes. Ideas and innovations designed to beat the odds and attempt to control risk emerged throughout the times. Starting from simple concepts in gambling like betting and rolling the dice, risk threaded its way to assuming possibilities in a mathematical and strategic sense in order to come up with a desirable and beneficial outcome (Arnoldi, 2009). Contemporary understanding of risk has introduced the use of mathematical and scientific theory to solve fields such as investment, insurance, medicine, and weather forecast. Perspectives in risk analysis can also be traced from areas such as political science, sociology, psychology, and economics with the understanding that variation of risk is the common denominator. Statistics developed as a reference point for research of risk and interpretation of the ability to gamble on certain situations. Time progression enabled rational choice theory and cost-benefit analysis where the identification of acceptable risk, voluntary risk, and involuntary risk influences decision-making. The eagerness to take risks is perpetual to the perceived benefit of a certain event, thus risk calculation and evaluation are at the leaders of decision-making (Hacking, 2006).

Risk can also be defined as the prospect of danger, injury, loss, and/or other consequences.[1] Managing risk is attempting to identify and manage potential issues that could severely impact a decision, practice or organisation. Risk management steps such

[1] Oxford Learner's Dictionary [Internet]. Oxford. C2023 [cited 2023 May 31]. Available from: https://www.oxfordlearnersdictionaries.com/definition/american_english/risk_1

as review of the operational system, analysing prospective threats to the organisation and prevalence of events, and devising suitable actions to target and eliminate threats are included in establishing an organisation.[2] The recurrent concept of risk management is that the particular allocation of the outcome distribution can be estimated and modified through diversifying the suggested resolution. To simplify, risk measurement depends on the analysis of particular behavioural attributes of the recommended actions that might result from the probable outcomes. One of the primary measurements of risk is variance which evaluates the scope of the results from the expected value. Through risk measurement, specific attributes that may contribute to harm or unwanted results are reduced or eliminated (Eyvindson and Kangas, 2018).

1.2.1 Risk Management

In the healthcare industry, work is fast-paced, regulation is highly implemented, and the environment is challenging. Adverse incidents occur at any given point and can potentially impact the organisation's operation, credibility, and most importantly the capacity to provide safe care. Risk in healthcare occurs in different areas such as patient's rights, medicine therapy, disease prevention and control, environmental safety, national laws and regulation, local standards, privacy, and resources. Any organisation related to healthcare shares categories of risk in fields of clinical, regulatory, environmental, and privacy with specific risks varying by organisation type. Size and complexity of the organisation are the driving force in the identification and evaluation of risk within the institution. Examples of risk identification are history of previous incidents, consultation, inspection, peer review reports, and observational methods to identify risk incidents and patterns. The source of risk information can be from brainstorming of staff, focus group

[2] Gayatari [Internet]. India. C2012 [cited 2023 May 31]. Risk Policy and Procedures. Available from: https://rb.gy/mltvee

discussions, employee reporting, archive reports, and patient satisfaction surveys. On a certain extent, these sources can evaluate and show a snapshot of internal and external risk drivers. Risk inventory is done to tally up risks identified by assigning value to each risk, quantifying situations and formulating appropriate solutions. Probability and severity risk matrix, or also known as risk assessment matrix, is a perceptible tool that portrays the risks influencing an organisation. The risk matrix utilises two interwoven circumstances: the prospect that the risk event will materialise, and the probable impact that the risk event will cause unto the whole system. The visual tool represents probability versus severity of conceivable risk. Risks can be classified into parts such as low, moderate, or high depending on the probability and severity. Organisations may utilise risk matrices to aid in prioritising distinctive risks and formulate an applicable strategy for mitigation as part of the process with risk management.[3,4]

Risk management in the healthcare industry is made up of different categories such as degree of identification of process and report design, administrative and clinical systems, risk assessment, monitoring, mitigation and prevention. Risk management utilisation provides a proactive and systemic approach for patient safety. Expanding from the traditional focus of patient safety, risk management accounts technological based risks such as cybersecurity, pace of medical science and research, and the regulatory, legal and political climate.[5]

[3] Hanover Insurance Group [Internet]. Massachusetts. C2021. [cited 2023 April 02]. Identifying risks in healthcare organisations. Available from: https://www.hanover.com/businesses/business-customer-resources/hanover-risk-solutions/identifying-risks-healthcare

[4] Audit Board [Internet]. London. C2021. [cited 2023 May 10]. What is Risk Assessment Matrix? And Why is it Important? Available from: https://www.auditboard.com/blog/what-is-a-risk-assessment-matrix/

[5] NEJM Catalyst [Internet]. Massachusetts. C2018 [cited 2023 June 01]. What Is Risk Management in Healthcare? Available from: https://catalyst.nejm.org/doi/full/10.1056/CAT.18.0197

ISO 31000:2018 [6] presents guidelines on how to apply risk management by organisations. Organisations can customise the guidelines according to their own practice. The document contains a general approach in managing different types of risks. Based on the ISO, an effective risk management requires elements such as integration, structure and comprehensive approach, customisation of risk management framework, inclusivity, dynamics, best current information, and continual improvement among others. The risk management framework serves as a guide for organisations in incorporating risk management into vital activities. The level of integration into governance is the key to assess effectiveness of risk management. Support from other actors such as stakeholders and top management moulds the standard to which decisions are made. Organisations are expected to assess current procedures and practices for risk management, calculate potential gaps and discuss gaps identified within the allowable framework. Implementation of risk management framework is sensitive to time and resources. Identification of how, where and when various types of agreement are formulated all over the organisation. The risk management process includes policy and procedure application, communication and consultation activities, assessment, treating, monitoring, reviewing, documenting and reporting risk. Implementation of the plan requires treating the identified risks. Electing the suitable risk treatment option does not exclude harmonisation of the possible benefits taken in behalf of reaching the set objectives. Treating risks may not necessarily be mutually exclusive to all conditions. Options may include other derivatives such as averting the risk by eliminating or reducing activities that triggers the risk, elevating the risk potential to go after an opportunity, reducing the main source of the risk, modifying the odds present, re-share the after-effect of the actions

[6] International Organisation for Standardisation (ISO) [Internet]. ISO 31000:2018 [cited 2023 June 01]. Risk management - Guidelines. Geneva: ISO Annual Meeting; 2018. Available from: https://www.iso.org/standard/65694.html

taken, sharing the risk (for example, purchasing an insurance), and retaining the risk through informed decision. The justification of treating risk exceeds applications and should include legal aspects such as obligation and general perceptions of the organisation. Careful consideration should be made in all aspects of the risk treatment as this could potentially bring in new and different risks that require further management.[7] Initial risk identification has a proactive relationship with vigilance. Actions performed during vigilance may greatly affect how risk is perceived and experienced. In wildlife for example, risk and size of an animal group are the two key factors in vigilance against predators where larger population size expects higher vigilance and provision of more safety (Beauchamp, 2019).

1.3 Vigilance

Vigilance is derived from the Latin word "vigilare" which means to stay awake or to care for, and is understood as the process of paying close and continuous attention.[8] Pharmacovigilance, otherwise called vigilance in medicines, is the discipline associated with the identification, estimation, interpretation, and aversion of the adverse effects or any other medicine-related issues. Identifying, analysing, and anticipating adverse drug reactions (ADRs) resulting from the use of a drug are the main principles of pharmacovigilance. ADRs are reported to be the fourth leading cause of death in the healthcare industry. Thirty-five per cent of hospitalised patients experience ADR during their hospital admission (Murphy and Frigo 1993). The overall prevalence of ADR is at 6.7% while that of fatal ADRs is at 0.32% in hospitalised patients, making

[7]International Organisation for Standardisation (ISO) [Internet]. ISO 31000:2018 [cited 2023 June 01]. Risk management - Guidelines. Geneva: ISO Annual Meeting; 2018. Available from: https://www.iso.org/standard/65694.html

[8] Notify Library [Internet]. Italy. c2022 [cited 2023 May 20]. Vigilance and Surveillance: History and Basic Elements. Available from: https://www.notifylibrary.org/content/3-vigilance-and-surveillance-history-and-basic-elements

pharmacovigilance's role essential for overall patient safety (Lazarou et al, 1998). The importance of pharmacovigilance is to ensure that a drug retains its safety profile, necessary drug information updates are executed, and when needed, prescription status is revised to the latest research results possible. Pharmacovigilance is founded on professional judgment of specialists who flag and analyse the side effects presented. Causality between drug use and possible side effects is ascertained and discussed within a cluster that closely include the health professionals, existing relevant literature, and other appropriate resources (Imbs and Welsch, 2002). Heissing R and van Troostenburg 2020 mentioned other principles that govern pharmacovigilance as a whole – regulatory management, data from clinical trials, collection and reporting of adverse events/ serious adverse events, and monitoring of patient safety and actions.

Vigilance is not only restricted to medicines but is widely utilised throughout the healthcare practice. Medical device vigilance system is established to enhance the conservation of health and safety of patients, healthcare professionals, and end-users by lowering the likelihood of incident recurrence related to the utilisation of a medical device.[9] A medical device or MD is described as 'any instrument, apparatus, implement, machine, appliance, implant, reagent for in vitro use, software, material, or other similar or related article, intended by the manufacturer to be used, alone or in combination for a medical purpose'.[10] Similar to medicines, MD adverse event reporting is necessary to reduce risk-related incidents such as injury or death (Yoon et al, 2019). Reported incidents

[9] European Commission [Internet]. Brussels. C2023 [cited 2023 May 03]. Market surveillance and vigilance. Available from: https://health.ec.europa.eu/medical-devices-sector/directives/market-surveillance-and-vigilance_en

[10] WHO [Internet]. Geneva. C2023. [cited 2023 April 07]. Medical Devices. Available from: https://www.who.int/health-topics/medical-devices#tab=tab_1

from the medical device industry of medical devices have emphasised the obligation for enhancements in the field of market surveillance.

The European Union (EU) public health safety issue involving the 'breast implants scandal' that surfaced throughout 2010 to 2011 was linked to a medical device manufacturer called Poly Implant Prosthèse (PIP). The issue highlighted the risk that a fraudulent manufacturer deliberately used an erroneous grade of silicone upon the manufacture of its breast implants, claimed that their product meets the requirements by Conformité Européenne (CE), bear the marking to their medical devices while knowing that this is actually false, and then concealing the whole activity from the public. An estimate of 400,000 women worldwide received the fraudulent silicone breast implants that contained the non-medically approved grade of silicone, introducing harmful risks to all recipients (Neerhof, 2019; Jarman et al, 2021). The Medicines and Healthcare Products Regulatory Agency (MHRA) issued a medical device alert for around 56,000 patients in the UK who were believed to be at risk of bone or muscle damage from the metal-on-metal hip replacement. DePuy, a company owned by Johnson & Johnson and manufacturer of the hip replacement device, paid the National Health Service (NHS) for the replacement of the defective medical devices and recalled the metal-on-metal hip system in 2010 after discovering that the wear and tear remnants were generating damage and resulting in a large number of surgical reassessments.[11] The assessment of the medical device incident cases showed that active and effective vigilance can help with the reduction recurrence. Different types of vigilance exist and are used according to different situations to promote safety.

[11] The Guardian [Internet]. London. C2018 [cited 2023 April 10]. Firm pays out to the NHS over defective hip replacements. Available from: https://www.theguardian.com/society/2018/nov/26/firm-pays-out-nhs-defective-hip-replacements

1.3.1 Types of Vigilance

Key components such as flexibility and adaptability are essential to establish an organised system during continuous uncertainties. The effectiveness of the key components is important for hazard management and risk governance where vigilance becomes a part of the application process. Vigilance has two general types: adaptive and indefinite. The first type of vigilance directly endorses adaptive type of management and is best described by vigilance through knowing the specificities of issues and deficits such as warning signals, filling gaps in knowledge, and ensuring smooth sailing of systems in place. This is considered as a head-on and direct approach to dealing with established probable issues. The second type of vigilance deals with an indefinite type of uncertainty where the person conducting the vigilance is not certain of what to look out for. Examples of such are the appearance of confusing signals from varied locations of the organisation and/or process, observing anomalies with different degrees, unacknowledged and unassigned responsibilities, and surprises. The two classifications of vigilance coexist, are equally important, and are related to each other but require different institutional management and may potentially work in opposition to one another. Adaptive type of vigilance requires laser-focus and head-on solutions, and knowledge-based framework while the indefinite type requires a bird's eye view of the situation while doing an inquisitive approach to current observations and concepts. Flexibility is then a blanket that offers coverage for the dilemma, but could be a challenge to most organisations especially when there are other vigilance arrangements already in place. In that case, societal and institutional recognition of vigilance as a multi-faceted action is an essential part of managing risks and hazards. Maintenance of vigilance needs consistency and sustained effort as part of an on-going process to be considered successful (Goble, et al 2018).

A study conducted by Wang, et al in 2021 discussed the effect of group size in terms of vigilance maintenance with animals called Tibetan wild ass. In this naturalistic observation, the researchers recorded five behavioural states including time spent on vigilance. The conclusion showed a decrease in frequency of vigilance with the increase of group size. Within the group, one or two animals are seen to be more hyper vigilant than others which essentially makes them the head of the group's vigilance. With this, we have to question the relativity of such observation with the vigilance that is known in the pharmaceutical industry. A way to look at it is the angle of potential fatigue with pharmacovigilance, which then relates to the few animals that kept the lookout. When a vigilance unit has to cover a range of responsibilities, sustained vigilance with a singular unit might result in exhaustion and in the end depleting the main purpose of vigilance. Decrement in vigilance can also be observed in elevated levels of workload and stress, with the latter including cognitive issues connected to the adequacy of performance (Grier, et al 2003). An approach called Threat Assessment Perspective formed by representatives of the U.S. Department of Justice and Federal Bureau of Investigation suggests the formation of assessment teams or groups that convene to identify, evaluate and address threats and potential threats. With the delegation-type of approach, there is a sustained level of vigilance without compromising the quality. Inclusion of an outside assistance can also contribute to the general quality of vigilance. Community participation and partnership plays a substantial role in maintaining vigilance. Each community member is most likely to be familiar with the process and could be consulted to aid whenever advice is needed. [12,13]

[12] Navigate 360 [Internet]. Ohio. C2023 [cited 2023 May 31]. The Impact of Vigilance Fatigue and How to Beat It. Available from: https://navigate360.com/blog-news/impact-vigilance-fatigue-beat/
[13] Canadian Centre for Occupational Health and Safety [Internet]. Ontario. C2021 [cited 2023 May 23]. Fatigue. Available form: https://www.ccohs.ca/oshanswers/psychosocial/fatigue.html

In countries with larger populations such as India, establishing pharmacovigilance centres, for medicines and medical devices for example, can enhance enforcement and coordination of the stakeholders for vigilance. Starting local within the hospital or related department, then extending to other hospitals from the next region, could create a web that covers multiple areas or zonal centres. The zonal centres, in turn, can communicate internally and externally to effectively disseminate reports that are vital to the vigilance practices of each organisation (Chakrabarty and Thawani, 2011).

1.4 Vigilance and Reporting in Medicine

Medicines undergo strict regulations to maintain a standard and prevent adverse events. Prior to authorisation for use, a medicine has to provide evidence of safety and efficacy from clinical trial results. The initial clinical trial translates to a limited quantity of participants where careful selection, and strict and controlled conditions are followed. Post authorisation, the medicine may be utilised in a substantial population of patients for an extended duration of time with or without other medicines. Add-on side effects may be expected to emerge in such conditions. In the European Economic Area (EEA), research and development require registration to EudraVigilance, the institution for supervising and examining information on suspected adverse reactions to medicines that have been approved or inspected in clinical trials. Marketing authorisation then follows where candidates are obligated to submit risk management plans (RMPs) that include documentation of a medicine's safety profile and strategies for pharmacovigilance activities. Risk minimisation in patients is explained and the measurement of these efforts is quantified with RMPs. Post-authorisation consists of the following requirements: Good pharmacovigilance practices (GVP), Medical literature monitoring, Medication errors, Medicines under additional monitoring, Incident management plan, Periodic safety

update reports, Pharmacovigilance systems, Post-authorisation safety studies, European Risk Management Strategy (ERMS), Regulatory and procedural guidance, and Signal management.[14]

The EU pharmacovigilance system was particularly reinforced in 2012 with the inception of new legislation delivering new processes, responsibilities, and tools. Incident reporting becomes the primary source of information and investigation, and allows adverse events to be analysed and investigated (Fukami et al, 2020). Prior to the reinforcement, European countries such as France, Italy, and Norway, have already established an occurring national-level reporting system, which accumulates adverse events and/or near misses reports from hospitals (Reed et al, 2014). ADR reporting, after the introduction of new medicines to market, is an essential part of the pharmacovigilance system (Januskiene et al, 2021). Underreporting is a well- recognised problem and prevalence is reported to be as high as 94%. The systematic review conducted by Hazel and Shakir 2006 provides evidence of significant and widespread under-reporting of serious or severe ADRs. Barriers to in-hospital reporting include factors such as fear of blame, inadequate feedback, lack of organisational support, and the notion that reporting does not equate to the enhancement of patient safety. While on national-level reporting, barriers include lack of funding for the vigilance system, apprehension due to sanctions, reduced participation of physicians, and few participating hospitals (Fujita et al, 2021).

From a cross-sectional study, healthcare professionals such as doctors, pharmacists, and nurses working in government tertiary-level care public hospitals in Pakistan have identified two categories of barriers in reporting events related to medicines. First category is the individual related barriers which include lack of knowledge, lack of

[14] European Medicines Agency [Internet]. Amsterdam. C2023 [cited 2023 May 27]. Pharmacovigilance: Overview. Available from: https://rb.gy/3vxmym

confidence to report, insufficient awareness about existing reporting systems, lack of time and interest. The second category deals with the system-related barriers such as lack of ADR reporting system, lack of online reporting system at the hospital level, difficulty of ADR forms, and lack of training. Among all of these, the three main barriers are the lack of knowledge if an ADR has occurred, followed by lack of time for reporting and lack of awareness regarding the actual reporting process although results across the professions have slight variations. With the same study, incentivising, allocation of more time and improving online reporting systems have been discovered to facilitate better ADR reporting (Hussain, et al 2022).

In 2004, a voluntary reporting scheme at the national level was established in the United Kingdom (UK) due to the challenge of under-reporting of serious adverse events all throughout the medical field. The problem with under-reporting was not improving until the government initiated the mandatory reporting system for serious adverse events in 2010 which entailed penalties for late or delayed reports (Eadi, 2012). All reported cases of suspected adverse reactions to medications authorised within the EEA are communicated to the EudraVigilance database. The database is designed as an electronic system in-charge to assemble and examine evidence on medicinal products safety. The reporter, a healthcare professional (for example, a physician, a pharmacist, a nurse or a dentist), and/or the consumer (for example, patient, patient's relative or caregiver) of the medicine that caused the adverse event becomes the originator of data on the safety of medicinal products. To verify the experience of an adverse reaction and its relationship to the use of a medicinal product, the consumer can supply any existing medical records stipulating such a suspicion supplied by healthcare professionals through systematic procedures such as laboratory tests or other medical data. When the patient's medically-capable relative, caregiver or friend authored the report, the data contained in the report

is considered valid. Establishing a drug safety profile is done through case-by-case inspection and summary report examination of safety of the medicinal products. The recognition of risks and transposition to the drug safety profile is constructed from the recognition and evaluation of the signals. The key points of the process are the effective communication of the reports from adverse reactions and the inspection of the current changes (Sienkiewicz et al, 2022). Similarly, medical devices also follow a vigilance and reporting system. The safety of both medicines and medical devices would define their usability to the public.

1.5 Vigilance and Reporting in Medical Devices

Medical devices are instruments that are intended to be used, alone or in combination, to prevent, diagnose, or treat disease or other conditions. The potential level of harm that medical devices might cause to users or patients determines how they are classified. A device that has more than one indication, may be identified by the its highest classification of use. Example of is a catheter that has two modes of use: 1) as short-term for peripheral artery use and 2) as intended for central circulatory use. The former is classified as a Class IIa device while the latter is a Class III device. Thus, if the manufacturer made a catheter that was for both indications (peripheral and central), the category of such catheter is considered Class III as it is the uppermost category for the device's manufactured purpose.[15] Generally, the classification of medical devices are based on the imminent level of risk each device carries. Class I devices are usually non-invasive devices that are intended to support general patient care such as surgical drapes, wheelchairs, and stethoscopes. Class II devices are subdivided into Class IIa and Class IIb. Class IIa

[15] European Medicines Agency [Internet]. Brussels. C2023 [cited 2023 May 29]. Medical devices. Available from: https://www.ema.europa.eu/en/human-regulatory/overview/medical-devices

devices are non-invasive and are meant to be used as channels or storage systems for blood, bodily fluids, cells or tissues, liquids or gases for the intention of prospective infusion, and administration into the body. Class IIb would be similar to Class IIa but with the intention of blood storage (for example blood bags). Class IIb devices are further expressed by non-invasive devices designed for biological or chemical modification of human tissues or cells, blood, and other bodily compositions including liquid, predetermined for body administration or implantation. Class III is labelled as non-invasive that contains substance or mixture of substances designed to be used in-vitro with direct connection to human cells, tissues or organs harvested from the human body, or meant for in-vitro with human embryos prior to inculcation into the body, and/or devices that are designed particularly for the following purpose: control, diagnosis, monitoring or correction of cardio or central circulatory system defects through direct contact with body parts relating to the organ systems. Exemptions are in place based on every device identification as each class comes with considerations depending on the use, duration of contact, invasiveness and such.[16]

Medical devices and medicinal products have a myriad of similarities in their nature, scope, or purpose. Despite the contrast in their essential means of action, they are often used concomitantly (Antich-Isern et al, 2021). The primary distinction is the directness of engagement since the medicinal products generally interact with patients while the medical devices frequently use a healthcare professional as an intermediary. The contrast between medical devices and pharmaceuticals emphasises the intricacy of the regulation with medical devices (Altenstetter, 2003). The vigilance of medical devices becomes more compound, despite having a similar structure to reporting medicines, as it involves

[16] Medical Device Coordination Group Document [Internet]. Brussels. C2021 [cited 2023 May 23]. Guidance on classification of medical devices. Available from: https://health.ec.europa.eu/system/files/2021-10/mdcg_2021-24_en_0.pdf

multiple key players even at the end-user level. The vigilance of both medicines and medical devices is neither interchangeable nor strictly applicable to each other. Each vigilance system can be used as a guide to one another while considering the applicability of each system areas. CE marking, instruction for use, and the life process of the medical device are examples of areas that are not relevant to medicines and might be disregarded if medicine vigilance is used over medical device vigilance for devices. Risks in areas of safety, conformity, and regulation may arise. The burden of operation of medical devices, in most cases, falls to the hands of the healthcare provider as most medical devices need an intermediary operator such as nurses, carers, doctors, technicians, pharmacists, and other trained healthcare professionals. The risk of safety does not only involve the patient but whoever uses the device to administer, collect and/or analyse patients and samples. For instance, Class IIb is treated as medium to high-risk devices and is often used within the body for 30 days or longer (such as ventilators and intensive care monitoring apparatus). The primary risk falls on the patient in a way that there is a chance of incorrect administration technique of the ventilator tube or detachment of the wirings to the intensive care monitoring equipment which may cause incorrect readings of vital signs. The secondary risk involves the nurse or nursing aid that monitors and operates the device by possible electrocution or similar electric accidents. Another class IIb example is the x-ray machine which is deemed to be relatively harmless to the patient once performed properly and with the appropriate gap between scans, but the technician that performs the test on multiple patients per work shift is exposed to a certain level of radiation every time which can accumulate and risk harm in the long run. A well-known example of medical device risk for healthcare workers is the use of a syringe (class IIa). Though this incident does not really fall strictly on medical device vigilance but more on the end-user, there is still a high prevalence of accidental needle stick injury which poses a great threat

to the health of the healthcare worker. Up to 94% of healthcare workers agree of having experienced an accidental needle stick injury and 44% agree that it is an unavoidable part of day-to-day work (Bhardwaj et al, 2014 and Swayze et al, 2011). [17,18] Establishments like hospitals and clinics have protocols in hand to ensure the safety of both patients and healthcare workers, but instances such as under-reporting connects back to the main risk of the medical devices vigilance which is the lack of documentation and communication of incidents.

Medical devices in the EU, after successful preclinical and clinical testing phases, must withstand a conformity evaluation to illustrate that the device conforms to the legal requirements required to warrant safety and good performance as intended. Following that, the medical device undergoes licensing for marketing and undertakes the post-market phase. Varied types of information affiliated to the verified intent of the medical device are gathered, and the post-market information is consolidated into the risk management plan (RMP) of the product (Pane et al, 2017). Regulation of devices at the EU Member State level through the European Medicines Agency (EMA) is a part of the regulatory process. The clinical evidence of performance of the medical devices are correlated and evaluation of the data evidence against the recommendations from International Electrotechnical Commission (IEC) and International Organisation for Standardisation (ISO) is done by the notified bodies (NB). The counterparts of these standardising committees such as the European Committee for Electrotechnical Standardisation (CENELEC) and European Committee for Standardisation (CEN) are included (Fraser et al, 2020).

[17] Obelis.net [Internet]. Brussels. C2023 [cited 2023 May 22]. Available from: https://rb.gy/3vecxj
[18] European Commission [Internet]. Brussels. C2017 [cited 2023 May 01]. Available from: https://ec.europa.eu/commission/presscorner/detail/et/MEMO_17_848

Manufacturers place a CE mark on medical devices upon completion of conformity assessment. The marking is only given to medical devices and available for medicinal products. The designated and certified NBs conduct the conformity appraisal which necessitates audit of the quality system of the manufacturer, and depending on the type of the device, reviews of the safety and performance from the scientific documentation of the medical device's manufacturer. The involvement of EMA in the process would specifically be with the medicinal products that include a medical device, also known as 'combination products', ancillary medicinal substance attached to medical devices, companion diagnostics or 'in-vitro diagnostics', medical devices consisting of ingredients that are systemically absorbed, and borderline products.[19] The Regulations on Medical Devices (Regulation (EU) 2017/745) modified the legal framework of the European Union as new responsibilities were introduced for EMA and national competent authorities (NCA) for the purpose of evaluation of certain medical device categories. With the new regulation, economic operators in the EU are obliged to cooperate with market surveillance authorities to foster transparency and patient safety (Pane et al, 2019).

Medical device incident reporting at the end-user level is a crucial part of medical device vigilance and should be promoted at every opportunity. Vigilance is limited by under-reporting and by the variability in the quality of the reports that are submitted. The post-marketing surveillance, through reporting from end-users and manufacturers, paves the way to identify such problems that may cause harm to patients. Similar to medicines, barriers with incident reporting of medical devices are present. Factors such as blame culture, education and training, response from distributor, incident recognition, procurement process, and feedback on report were some major root causes of reduced

[19] European Medicines Agency [Internet]. Amsterdam. C2023 [cited 2023 April 23]. Medical devices. Available from: https://www.ema.europa.eu/en/human-regulatory/overview/medical-devices

incident reporting with medical devices.[20] The importance of reporting device incidents should be emphasised as this helps pinpoint risks at the earliest possible time point. In a healthcare setting, other insights from the profession include non-reporting culture, absence of acceptance or awareness that the event was related to a device and only contacting the in-charge, regulator, or supplier upon expiry of the warranty period. One example of estimating the under-reporting levels would be the case of the urogynecological mesh approved for supply in 1998 and received by the Therapeutic Goods Administration (TGA) in Australia in 2006. In 2012, 63 incident reports were received associated with the urogynecological mesh. Increase in public awareness of complications linked to the device translated to an escalation of reports in the next five years. Additional 186 reports were received as of 29th May 2017. From the inquiry of the Australian Senate, 2400 women (as of 3rd of August 2017) had disclosed their medical device experience. The discrepancy with the numbers indicate that the under-reporting of adverse events is still a major drawback for vigilance (Craig, et al 2019).

Coordination and participation of end-users are important. The data from end-users allows probable incidents to be reported to the NCAs and manufacturers, and with conscientious engagement and investigation, Field Safety Corrective Action (FSCA) implementation becomes feasible (Almadi and Alsohaibani, 2019). FSCAs are described as 'actions taken by manufacturers to reduce a risk of death or serious deterioration in the state of health associated with the use of a medical device' already on the market.[21] Actions taken may include label changes, modification of instructions, and issuing recalls. FSCA details are communicated by manufacturers to end-users in the form of Field Safety

[20] Cardona Xuereb P. Regulation of Medical Devices [Dissertation]. Msida: University of Malta; 2020

[21] European Commission [Internet]. Brussels. C2013 [cited 2023 April 18]. Guidelines on Medical Device Vigilance System. Available from: https://ec.europa.eu/docsroom/documents/32305/attachments/1/translations

Notices (FSNs) (Kramer, et al 2014). Notification from the manufacturer or authorised representatives should be forwarded to the proper National Competent Authority (NCA). The notification includes details about the field safety corrective actions and incidents whenever the criteria for reporting are achieved. Investigation and taking corrective actions are then necessary while ensuring that the authorised representatives within the jurisdiction are aware of the guidelines. On an event where the use of two combined or more separate devices and/or accessories from different manufacturers caused an incident as a consequence of use, reporting to the relevant NCA is done separately. Reporting the incident is not a confirmation of fault or liability for the incident and the aftereffects but rather a notification of investigation and information. Thus, written reports may be attached as a disclaimer in this regard. Cessation of a particular medical device model from the market does not exempt the manufacturer from vigilance reporting obligations under MDR. However, a manufacturer's legal trading arrangements change with mergers and acquisitions. When the obligations for vigilance and post-market surveillance-related activities are being relocated to a separate or different legal entity, the post-market surveillance activities carry over and the Competent Authorities (CAs) are made aware of the implications. New details of the contract and contacts are provided to minimise any existing and potential negative effects caused by the change to the overall operation of the vigilance system.[22] The incident investigation initiated by the manufacturer is being followed by the NCA and necessary supplementation of further activity may be done accordingly. Depending on the results of the thorough examination of the event, any necessary information for the mitigation of potential events (or the prevention of their consequences) should be shared by the NCA.

[22] European Commission [Internet]. France. C2023 [cited 2023 May 20]. Guidelines on a Medical Device Vigilance System. Available from: https://rb.gy/mxdkec

The Compliance Exchange Form or CEF is a communication between NCAs and/or Designating Authorities (DAs), and in other situations, NBs, depending on the information needed. The CEF is a form of vigilance that is exchanged between EU member states and occurs through consulting another EU member state regarding a particular medical device. Countries under the EEA are included in the exchange. The member states are expected to safeguard the involvement of individuals and/or organisations with the sale of the medical device, and ensure cooperation to maintenance of the vigilance chain. The competence of the vigilance system is enhanced through the NCA's encouragement of reporting of incidents by end-users, professionals involved in the distribution including individuals and stakeholders liable for the provision of calibration and medical device maintenance. End-users should report medical device incidents to the relevant manufacturer or NCA according to the national practice. Upon identification of the relevant corrective action, the end-user representative, healthcare professionals, and hospital administrators liable for the care and safety of medical devices can adopt appropriate steps, wherever applicable, in full-cooperation with the manufacturer.[23] CEF provides another layer of medical device vigilance within the EU.

1.5.1 CE Marking

For a device to be sold in the EU, it has to bear the CE mark which indicates that the device has gone through assessment by the manufacturer and has met the minimum technical and legal obligations necessary such as safety, health, and environment protection. The arrival of the new regulation means that there is the mutual technical base provided for the function of the manufacture of products and ensures the opportunity of dependable information for consumers, public authorities, and professionals. The CE

[23] HPRA [Internet]. Ireland. C2021 [cited 2023 May 07]. Guide to Incident Reporting for General Medical Devices and Active Implantable Medical Devices. Available from: https://rb.gy/kv5vew

marking is compulsory and provides an add-on purpose to other distributors and manufacturers by supporting the marketing of the devices within the EU territory, and supports fair competition by holding all companies accountable to the same rules. The marking also ensures that the presentation of products is communicated and supported by specifications, standards and documentation needed in each use. Obtaining CE marking requires the following: 1) conformity with all relevant EU-wide requirements, 2) determining if the manufacturer can perform a self-assessment of the need to involve a notified body, 3) producing a technical inventory recording the compliance, and 4) drafting and signing an EU declaration of conformity (Muedra, 2018).[24,25] Although, not all CE marking means the same thing. Another CE symbol within the medical device market has been identified recently. The CE symbol, which means China Export, closely resembles the CE mark but is different from the standard European CE mark. The CE symbol is used in products imported from China especially when entering the EU market. The standard CE mark consists of the letters C and E, which are formed by interlocking circles with the same radius, with a certain distance between them, and indicates that the product has been constructed and certified in agreement with European directives. The product bearing this sign is free to circulate in the European market. The CE symbol, which is claimed to be the abbreviation of China Export, shows that the letters C and E are close to each other where the letter E is located right next to the letter C and there is no extra space in between letters. The China Export symbol is placed arbitrarily by Chinese manufacturers and does not confirm any testing or approval. The C and E letters, when closer to each other than specified in the standard format, can be considered as

[24] Malta Competition and Consumer Affairs Authority [Internet]. Malta. C2020 [cited 2023 April 04]. CE marking. Available from: https://mccaa.org.mt/Section/Content?contentId=1132
[25] Europa.eu [Internet]. Brussels. C2023 [cited 2023 April 05]. CE marking. Available from: https://rb.gy/9ujpy9

fake.[26] Apart from the official CE marking, there is another marking that is visible to medical devices and ensures the quality of the device. The Unique Device Identifier or UDI is a marking in a form of a lined barcode which contains important data regarding the device.

1.5.2 Unique Device Identifier

The sale and marketing of medicines throughout the EU undergo standardised checking to ensure that there is no defective, falsified, or unsafe products. Secondary packaging of medicines for human use has a unique identifier (UI) and an anti-tampering device (ATD) (Frontini, 2017). The ATD is usually a seal sticker strategically placed between the opening flaps of the box packaging. The design prevents any medicines with tampered or broken seals to be sold off to the public and serves as a physical indication of possible falsification.[27] Similarly, medical devices contain a unique device identifier (UDI) which allows the 'identification and facilitation of the traceability of devices, other than custom-made and investigational devices'. The UDI is used to adequately recognise and track the device throughout its life cycle and distribution, and is used according to the relevant requirements of the regulation. The UDI is set up on a database to 'validate, collate, process and make available to the public' details regarding the manufacture of the medical device available without including commercially confidential information.[28] Medicines, in parallel to medical devices, and their UI are stored in a database that tracks the movement of the medicine. The scanning of the UI code of the medicine follows a verification system and authentication process. With the medicine UI code, an alert is

[26] Weerh C. Researchgate [Internet]. Product Safety CE alert: CE fake signs from China. 2019 [cited 2023 Feb 23]. Available from: https://rb.gy/wey6q2
[27] European Commission[Internet]. Luxembourg. C2016 [cited 2023 May 31]. Commission Delegated Regulation (EU) 2016/161 of 2 October 2015. Available from: https://rb.gy/9jydp2
[28] EUR-LEX Europa [Internet]. Luxembourg. C2017 [cited 2023 May 31]. Regulation (EU) 2017/745 of the European Parliament and of the Council of 5 April 2017. Available from: https://rb.gy/mlsex6

raised when the medicine does not belong to the circulation, the batch has been tampered and/or the medicine being scanned is expired or recalled. The alert system prevents any fake or tampered medicines from staying in the market and being dispensed to the general public.

The UDI of medical devices does not serve as an alert system. For medical devices, the purpose of the device identifier is a form of designation from manufacturers containing all relevant information, device model, and specifications. The UDI is used by economic operators to monitor which devices have been supplied and which class of medical device they belong to. Medical device data is stored in the European Database for Medical Devices (EUDAMED). The EUDAMED system is used as a repository for significant clinical information about registered medical devices. The intention is to enhance systematisation and transparency of product specifications about the medical devices circulating within the European Union. The web-based portal that functions as a central date hive is a secure program that supports exchange of product's regulatory data among MD manufacturers, notified bodies, competent authorities, healthcare practitioners, and the general public. Six interconnected modules and a public website builds the EUDAMED. The modules include market surveillance, vigilance and post-market surveillance, clinical investigations and performance studies, notified bodies and certificates, UDI/ device registration, and actor registration. Submission of data to EUDAMED differs substantially in comparison to other organisations such as U.S Food and Drug Administration (FDA). EUDAMED is more extensive, requires registration of regulation devices and legacy devices that are already existing under the former MDD. Submissions of regulatory documents are also included for post-marketing surveillance such as, but not limited to, Manufacturer Incident Reports (MIRs), Field Safety

Corrective Actions (FSCAs) and Periodic Safety Update Reports (PSURs).[29,30] The design of the monitoring system aims for proper detection and complete documentation in cases of incident reports. Any changes regarding the medical device information such as storage and handling data, and instruction for use are logged in and recorded for effective tracing.

1.5.3 Instruction for Use in Medical Devices

'Instruction for use' is a requirement issued from the medical device regulation concerning the information to be provided by the manufacturer. A device must contain the information to recognise the device and its manufacturer, safety, and usability data relevant to the user, or any other person, as necessary. The information is to appear on the (1) actual device, (2) manual or in the packaging for the instruction for use, and if applicable, (3) website of the manufacturer. The instructions for use should be formulated and printed with easily accepted terms by the intended user, and if relevant, accompanied by illustrations and figures. The location, legibility, content, medium, and format of the instruction for use and label should be according to the design of the device, technical knowledge, and intended purpose. In situations where it is not appropriate for the label to be written on the device itself, the relevant information may be assembled on the packaging per unit, and/or on the collective packaging of the devices. Aside from being human-readable, the label may also be accompanied by information that is readable through machines such as the radio frequency identification or RFID, and/or barcodes.[31] The following shall be visible on the label: intended purpose, the name, registered trade

[29] Holborow R. BSI Group [Internet]. Periodic Safety Update Report. 2020 [cited 2023 May 31]. Available from: https://rb.gy/0rzrq
[30] News-Medical.net [Internet]. Understanding Regulatory Submissions and the Role of Regulatory CMC Project Management. 2020 [cited 2023 May 31]. Available from: https://rb.gy/8hldr
[31] EUR-LEX Europa [Internet]. Luxembourg. C2017 [cited 2023 May 31]. Regulation (EU) 2017/745 of the European Parliament and of the Council of 5 April 2017. Available from: https://rb.gy/mlsex6

name, or registered trademark of the manufacturer, address of the registered place of business, name or trade name of the device, details accurately needed for the user to identify the device and contents of the packaging. The label must also contain, where applicable, the use or purpose that the device contains or incorporates medicinal substance (human blood or plasma derivative), tissue, cells and/or their derivatives, lot number or the serial number of the device, UDI carrier, demonstration of time limit for use or implantation, storage and handling condition, and if applicable, sterilisation methods and 'custom-made device' if it is custom-made for an institution or alike. The device label must indicate that it is a 'medical device', or 'exclusively for clinical investigation' if the manufacture of the device is intended for the purpose of exclusive clinical investigation. In addition, the instruction for use should indicate clearly the performance characteristics of the device and where applicable, link to the synopsis of safety and clinical performance indicated in Article 32 of the MDR. Risks that are residual, any undesirable effects, and contraindications, preparatory treatment, or handling before, during, and after use are expected to be stated. The issue date or updated revision of the instructions for use and, where relevant, an identification number should also be incorporated.[32] The regulations relay stipulations regarding the appropriate action due when there are related to modifications and changes. The notified body shall have recorded policies and contractual harmonisation with manufacturers in present pertaining to the manufacturers' duty and commitment, and the evaluation of revisions to the intended indication of or declarations designed for the device. The notified body must

[32] The Global Harmonisation Task Force [Internet]. Ottawa. C2011 [cited 2023 May 31]. Label and Instructions for Use for Medical Devices. Available from: https://rb.gy/sjeekb

notify the manufacturer of any conclusion and resolution, and supply a report, such as supplementary report, that caters for the rationalised conclusion of the evaluation.[33]

The Guidance document for the medical devices specified that the 'correction of spelling mistakes or merely editorial changes and/or updates of the information to be supplied with the device (label or instruction for use) are mere clarifications and do not adversely affect the devices' safety and performance in relation to existing or new risks'. Non-significant changes such as 'change of instructions for use to refer better precision of the device based on data obtained as a result of post-market surveillance or addition of new interfering or cross-reaction substances and clarifications of labelling or instruction for use' are only valid when the revision does not relatively affect the safety or implementation, and no negative effect to the risk/benefit ratio of the device.[34]

The instructions for use of medical devices are needed from manufacturers to conform to the MDR, failure to conform may result in the ordering of a marketing or sales freeze from competent supervisory authority. Manufacturers could also be held responsible for liability risks as manufacturers are not only responsible for injuries transpiring from the operation of a hazardous or defective device but also injuries sustained through incorrect utilisation of the device by its end-users due to the confusion of the instruction for use (wording is difficult to understand, incomplete phrases, wrong use of words or unclear relay of steps). Wrong translations could also cause errors in usage and risk harm to the

[33] EUR-LEX Europa [Internet]. Luxembourg. C2017 [cited 2023 May 31]. Regulation (EU) 2017/745 of the European Parliament and of the Council of 5 April 2017. Available from: https://rb.gy/mlsex6
[34] Medical Device Coordination Group [Internet]. Brussels. C2023 [cited 2023 May 31]. Guidance on significant changes regarding the transitional provision under Article 110(3) of the IVDR. Available from: https://health.ec.europa.eu/system/files/2022-05/mdcg_2022-6.pdf

end-users.[35] Correct documentation, instruction, and standardisation are important to prevent risks in using medical devices and reduce risk of harm for the end-users.

1.6 European Database on Medical Devices

The European Database on Medical Devices or EUDAMED is a system that is developed by Regulation (EU) 2017/745 on medical devices and Regulation (EU) 2017/746 on in-vitro diagnosis medical devices.[36] The European Commission (EC) established the system and is a vital part of the Regulations for Medical Devices implementation. The creation of the database provides an updated data of the life cycle of a medical device made available in the EU. Varied electronic systems are integrated to compare and develop information involving the medical device and the related companies (for example manufacturers). Transparency is one of the main aims of EUDAMED where there is public access to essential information, and allocation of data about medical devices made available in the EU market. The secure, web-based portal acts as an interpretable registration, collaboration, reporting, and dissemination system that provides access to relevant medical device information.[37] The use of Eudamed2 has been obligatory since May 2011.[38] Effectivity of EUDAMED relies on compliance of each actor and stakeholder in ensuring that all steps of the process are being followed diligently.

[35] Reuschlaw [Internet]. Berlin. C2020 [cited 2023 May 31]. MDR: Requirements for instruction for use for medical devices. Available from: https://rb.gy/aikz8j
[36] European Commission [Internet]. Brussels. C2023 [cited 2023 March 12]. Market surveillance and vigilance. Available from: https://rb.gy/tq7rej
[37] European Commission [Internet]. Brussels. C2023 [cited 2023 February 23]. EUDAMED database. Available from: https://ec.europa.eu/tools/eudamed/#/screen/home
[38] European Commission [Internet]. Brussels. C2023 [cited 2023 March 13].
Medical Devices - EUDAMED: Overview. Available from: https://rb.gy/bnzvac

1.7 Joint Action for Market Surveillance

Market surveillance activity, if valuably outlined and attentively targeted, can assist in recognition of non-compliances efficiently. The joint plan, PIP Action plan for an urgent action, was instituted by the EC subsequent to the scandal involving the PIP breast implant with the goal of re-establishing the assurance and preservation of safety in medical device use. Control measures based on the current legislation were adapted for the improvement of protocols. The PIP Action plan concentrated on the obligation for supplemental control to the regulatory system's main sector for medical devices, vigilance coordination, market surveillance, undertaking of notified bodies, transparency, and communication.[39]

The Joint Action on Market Surveillance of medical devices or JAMS was developed to coordinate the proposition for all Member States and to establish market surveillance between Competent Authorities. The Joint Action was initiated in October 2016 where 18 countries gathered and the plan was carried out until January 2020, a span of 39 months. Best practices, coaching, education, and resources were shared through the outputs and projects between NCAs. The coordination aimed to boost the safety of the general public reached by the medical devices department. Improvement in cooperation and assistance to NCAs with lesser resources to enhance skills and capabilities for the European medical device market surveillance structure is one of the vital goals of the project. The assistance is expected to promote an equal and consistent proposition through all NCAs in joint manufacturer inspections, optimal cooperation in EU high-profile events, and development of relevant clinical resources. The surfacing of the publicised events in past years (for example PIP breast implant) and the application of the legislative

[39] EUR-LEX Europa [Internet]. Luxembourg. C2013 [cited 2023 May 25]. Regulation (EU) No 920/2013 of 24 September 2013. Available from: https://rb.gy/96cje8

changes within the medical device unit have shed light to the importance of collaborative effort between stakeholders (for example NCAs) to promote mitigation of oversights from the medical device market, develop the protocols utilised for data sharing, and correlate market surveillance activities which reflects the regulation for medical devices. The JAMS relate to the accomplishment of the Health Programme goal by navigating tools and guidance to assist in the assertion of joint inspections of manufactures and to promote the clinical process and market surveillance cooperation between EU Member States. The current medical devices regulatory system is more prepared to effectively and efficiently ensure oversight in the medical device industry. The level of preparedness resulted in a positive impact on patient safety with medical devices in Europe, and good confidence level from healthcare professionals, consumers, and patients in the medical devices available in the European market. The initiative is viewed as a vital contribution to the medical device regulation implementation. Through dissemination, the Joint Action has continuously promoted and encouraged the importance of contributions for all stakeholders that are able to advance towards the medical device market surveillance. The Joint Action consists of five work packages with each focusing on reaching certain objectives that contribute to the overall goals of the safety of the medical devices.[40] Enforcement of the harmonised medical devices legislation is a responsibility of different authorities all throughout EU member states. The Directive establishes specific procedures that are to be followed by the National Authorities (NA) in regards to safety of medical device and safeguard clause or the status of potential withdrawal from the market, and CE marking affixation. The EU countries establish requirements on health-related events in line with the withdrawal of a medical device from the existing market

[40] European Commission [Internet]. France. C2022 [cited 2023 May 25]. Joint Action on Market Surveillance of medical devices. Available from: file:///C:/Users/user/Downloads/Attachment_0.pdf

for health monitoring measures. [41] The establishment of the vigilance system in the EU creates a web of information and support to detect non-compliant medical devices and prevent penetration of such devices in the EU market. The openness to vigilance allows end-users and other stakeholders to understand the importance of maintaining compliance with the Regulation. In addition, understanding the vigilance systems of other countries outside the EU is beneficial as it serves as inspiration of ideas and reference for approaches wherein vigilance can be strengthened and improved.

1.8 Medical Device Vigilance Systems Outside EU

The medical device vigilance practices outside EU vary in resources, standards and systems. The universal goal is to protect the general public from imminent harm by ensuring each medical device is appropriate for use, prevent occurrence of incidents caused by devices, and promote safety of end-users all throughout the prospected life cycle of the medical device.

1.8.1 United States of America

The Medical Device Amendments to the Federal Food, Drug, and Cosmetic Act (FDCA), the Food and Drug Administration (FDA) of 1976 has been provided with the instruction to guarantee safety and usefulness of medical devices (Kramer, et al 2014). Following the FDCA, medical devices are categorised into 3 classes (class I, II, and III) based on their levels of risks. The Centre for Devices and Radiological Health (CDRH) of the FDA has the sole responsibility of managing medical devices within the US market. FDA

[41] European Commission [Internet]. Brussels. C2023 [cited 2023 March 2]. Market surveillance and vigilance. Available from: https://rb.gy/0keud9

regulations for medical devices include the post market management, quality system, clinical investigation, and premarket approval (Chen et al, 2018).

Medical device reports such as medical device malfunctions, serious injuries, and potential device-related deaths are received by the FDA on a yearly basis. The Medical Device Reporting (MDR) system is one of the tools the FDA utilises for post market surveillance for the purpose of medical device performance monitoring, suspected device-associated safety issues detection, and risk-benefit ratio assessment contribution of the medical devices. Importers, device users and facilities, and manufacturers are considered mandatory reporters. The stakeholders are obliged to submit specific types of reports to the FDA for issues such as medical device-related concerns and product adverse events. Additionally, consumers, caregivers, patients and healthcare professionals are encouraged by the FDA to volunteer in putting forward reports about serious cases of adverse events that may be related to a medical device, errors of use and function, issues about product quality, and failures in therapy. The reports, together with the information from other sources, can endorse critical data that enhances overall patient safety. All MDRs received are constantly checked by the FDA. The analysis data of FDA about MDRs assist in the evaluation of the general information provided by any initial or existing MDR, and the supplemental MDR reports provided after. The capitulation of an MDR alone is not a form of proof that the device being utilised introduced or resulted in the adverse event or outcome. For example, certain MDRs contain words of report including the word "death" or another related terminology. But the MDR, in any circumstance, cannot immediately classify death until the investigator is certain that the actual cause of the patient's demise was, in any way, related to the device, or the device contributed to a factor that resulted in death.

Moreover, even if MDRs are a source of vital information, this surveillance system is passive and has occurring limitations. The reporting system on itself cannot finalise the cause of an event, prevalence, or incidence due to the probability of event under-reporting, report inaccuracies, insufficiency of device verification being directly related to the event reported, and absence of information relating to frequency of usage of the device. Due to these hindrances, MDRs are not the sole source but only one of FDA's multiple vital post market surveillance information sources. Regulation 21 CFR Part 803 consists of compulsory standards for device user facilities, importers and manufacturers to put forward any report for device-related adverse events and issues from products to the FDA. [42]

The medical devices US Quality System Regulation (QSR) for is founded on Title 21, part 820 of CFR (21 CFR 820). Manufacturers are required by the US FDA to apply the Good Manufacturing Practice or GMP to their facilities to guarantee that the medical devices produced are at par with the requirements of QSR, unless the product falls under Class I devices where the certain products are not produced sterile. With that, device manufacturers that are excluded from the GMP by the US FDA are still obliged to maintain files with complaints received (21 CFR 820.198) and general standards for record keeping (21 CFR 820.180). The clinical studies of medical devices in the US are branched into non-significant risk (NSR) and significant risks (SR) device studies.[43] SR device studies require IDE or investigational device exemption application upon planning. Both FDA and an Institutional Review Board (IRB) must release an approval before sponsors of the medical device can conduct the study. Devices under NSR studies

[42] U.S. Food and Drug Administration [Internet]. Maryland. C2023 [cited 2023 May 31]. Medical Device Reporting (MDR): How to Report Medical Device Problems. Available from: https://rb.gy/9sgk4
[43] US FDA [Internet]. Maryland. C2016 [cited 2023 May 07]. MDSAP Mid-Pilot Status Report. Available from: https://rb.gy/x05f3

would only require the approval of the IRB, and follow the IDE abbreviated requirements like record-keeping, monitoring, informed consent, and labelling while the study is on-going. The requirements for post market surveillance on medical devices in the US include establishment of registration, reporting of device malfunction, device-related serious injuries or deaths, and tracking systems for the device's lifespan. In addition, the US FDA obliges post market surveillance studies for certain class II and/or class III devices (FDCA section 522) that are life-supporting or life-sustaining, implanted in the body for 1 year and more, importantly utilised in the paediatric field, or those which failure would most likely result to a serious adverse health reaction. [44]

1.8.2 Canada

Guidance documents for incident reporting are designed to provide assistance on the requirements in complying with the governing regulations and statutes. The documents also serve as an aid to healthcare professionals and staff on the requirements about Health Canada mandates and to classify which goals are to be followed in a manner that is effective, consistent, and fair. Since they are administrative tools without legal authority, guidelines permit a flexible approach. Alternative methods to the guidelines' guiding concepts and practices could be permitted as long as they are well justified. Section 60(1)(a) of the regulations preliminary reporting requires that if the serious deterioration of health of the patient, user or other person, or death has occurred, a report must be forwarded to Health Canada within the span of 10 calendar days. If the serious deterioration in health, or death did not occur due to the event, but has the potential to do so where there is event recurrence, a report is still to be submitted to Health Canada within

[44] US FDA. [Internet]. Maryland. C2016 [cited 2023 April 29]. FDA strengthens requirements for surgical mesh for the transvaginal repair of pelvic organ prolapse to address safety risks. Available from: https://rb.gy/kas3w. Published January 2016.

the span of 30 calendar days. The reporter would propose a timeframe for applying any corrective actions received and for putting forward the final report as part of the preliminary reporting requirements. The importer and/or the manufacturer of the device can also submit a report. The report with the proposed timetable is reviewed by Health Canada to make sure that there is no conflict between the investigation and the safety of the patients and users. A final report is provided by the reporter as soon as the data is present, or as required by Health Canada. Proposed dates related to the action plan for the resolution of the issue is included on the timetable, and should not exclusively contain the recommended submission date for the final report. When an investigation is considered to be in a premature state (for example, a report for 10 days), it is permissible that the timetable only indicates the immediate activities taken or planning to be taken, and the probable date(s) for updates and for the final report. After assessment and investigation, a final report based on Section 61(2)(a) obliges the reporter to provide information such as complete account of the occurrence, quantity of persons who encountered the incident and their health disposition, a detailed report of the event and rationale for any actions performed in line with the occurrence, and measures taken as a result of the investigation. Enhanced corrective and preventive measures about the layout and manufacture of the device, elevated device post-market surveillance, and/or device recall are examples of interventions that could stem from investigations. The account of the incident in the final report is not open to other interpretations and is complete, including all new data acquired since the presentation of the introductory report. Discussion about any actions of repair or replacement after the filing of the introductory report would also be included in the report document, and the particulars of the replacement or repair are added. The reporter is obliged by Section 61(2)(b) to present a comprehensive account of the primary cause of the incident and the justification for the

resolutions taken in line of the event. The statements in the report should be direct, scientifically understandable, and compatible with the information provided and other important data present. The justification should showcase proof that the suggested route of action will rectify the issue and reduce risk of recurrence. The reporter is obliged by Section 61(2)(c) to put forward any actions done as an outcome of the investigation. The report may indicate actions towards device recall, corrective and preventive action accounting the style and manufacture of the medical device, and enhanced efforts for post-market surveillance of the medical device.[45] In the event that Health Canada decides that the medical device may seriously or imminently harm end-users and the general public upon conclusion of investigation, recall may be initiated and other existing devices may be sent off to a specific place for further analysis. Recall notification and initiation may involve medical device removal from the current market, immediate halt on public usage and destruction of remaining units, device on-site corrections, supplementation of advice to the users regarding the problem and potential problem, and supply of altered or corrected labelling such as updates to instructions or manuals. In Canada, recall is considered a collaborative process where different parties within the distribution chain are involved. The collaboration involves consumers, users, healthcare facilities, retailers, distributors, importers, and manufacturers. Depending on the case, some manufacturers have an established agreement with their importers or distributors in regards to recalls, thus certain processes in that aspect might change from one device to another.[46]

[45] Health Canada [Internet]. Edmonton. C2021 [cited 2023 April 25]. Incident reporting for medical devices: Guidance document. Available from: https://rb.gy/x0xutp
[46] Health Canada [Internet]. Edmonton. C2016 [cited 2023 April 30]. Guide to Recall of Medical Devices. Available from: https://rb.gy/8hstlt

1.8.3 United Kingdom

The Medicines and Healthcare Products Regulatory Agency (MHRA) is the executive authority for the medical device regulation in the UK market. Adverse incidents that happen in the UK involving medical devices must be communicated to the MHRA. Since the 1st of January 2021, there have been changes in the placement of medical devices through secondary legislation. Registration of MD must go through MHRA and recognition of CE marking will be continued until 30th June 2023. The validity of the certificates issued by a NB that is EU-recognised will only be accepted until the same date. In an event that the manufacturer does not hold their main office in the UK, a Responsible Person established in the UK must be appointed to register and authorise on their behalf. Upon placement of the medical device on the UK market, the manufacturer is required to put forward vigilance reports to the MHRA whenever specific types of incidents include the device. The UK vigilance system still mirrors the EU vigilance system in a way that the communication and investigation of adverse events and FSCA are still utilised. The responsibility of reporting is with the authorised representatives based in Northern Ireland, the responsible person in the UK, and the manufacturer. Anyone from the three stakeholders can send notifications to the MHRA regarding incidents and FSCAs involving Periodic Summary Reports or PSR and trend reports. Similar to the EU vigilance system, the manufacturer is also liable for any investigation with the incidents and for taking the necessary course of corrective action. The UKCA marking or UK Conformity Assessed is a UK product marking utilised for specific products, involving medical devices, available in England, Wales, and Scotland market or the Great Britain. In the EU, EEA, or Northern Ireland markets, the UKCA marking is not honoured or recognised. For medical devices that are to be marketed in Great Britain until June 30 2023, the manufacturer can choose between the CE marking or the UKCA

marking on devices. Following that date, the UKCA marking will then be compulsory for the medical device placement within the Great Britain market.[47] The UK-based conformity assessment bodies are called as UK Notified Bodies, for the sake of the Northern Ireland market. Manufacturers of medical devices are obligated to apply the 'UKNI' or UK(NI) indication whenever UK NB is utilised as a mandatory third-party conformity assessor, and the indication is always applied with medical devices containing the CE marking. Medical devices with the combined "CE & UKNI" marking will not be automatically accepted in the EU market, thus these devices would be required to follow the separate EU-recognised marking. The incident reporting system revisions include manufactures sending reports of post-market vigilance to MHRA through a portal system or through forwarding a XML output of the MIR or Manufacturer Incident Report form towards the designated email address.[48] The change from November 21 2022 consists of related reports about adverse events for medical devices to the MHRA that must be submitted through the new portal or through the Application Programming Interface or API for direct submission from the internal systems. An incident that accommodates all three of the reporting requirements is treated as an adverse event or incident. The first criterion is an event that occurred where examination of the data available with the device, testing performed on the device or availability of any scientific data concludes potential involvement, or has involved, of the device to the event. The second criterion is when the device from the manufacturer is suspected to be the main issue, or part of the incident. The third criterion is where the event has transpired in, or might potentially result in, serious deterioration in the state of health, or death, of the user, patient, or another person.

[47] GOV.UK [Internet]. United Kingdom. C2023 [cited 2022 May 08]. Regulating medical device in the UK. Available from: https://rb.gy/pfn4yt

[48] PIPA [Internet]. Surrey. C2021 [cited 2023 May 08]. UK Medical Device Vigilance Guidelines. Available from: https://pipaonline.org/wp-content/uploads/2021/05/PIPA-UK-Medical-Device-Vigilance-Guidelines.pdf

On that note, not all existing adverse events end up with serious deterioration of health or death. The events may have been prevented due to circumstances, or due to intervention. Reports should still be sent if an incident corresponding with the medical device has materialised, and if there is a recurrence, it might lead to serious injuries or death. [49]

1.9 Aims of the Study

The aims of the study were to 1) evaluate perspectives of end-users with medical device incident reporting, 2) assess and develop a database for medical device Compliance Exchange Form (CEF) received by the medical device directorate which contains medical device inquiries from Competent Authorities (CA) and Designating Authorities (DA) within the European Union, 3) assess procedures used by a competent authority in handling incident reports, and 4) develop a risk management plan for risk mitigation**.**

[49] GOV.UK [Internet]. United Kingdom. C2023 [cited 2023 May 15]. Medical devices: guidance for manufacturers on vigilance. Available from: https://www.gov.uk/government/collections/medical-devices-guidance-for-manufacturers-on-vigilance

Chapter 2

METHODOLOGY

This chapter contains the methodology performed to carry out the aims of the research.

2.1 Research Phases and Methods

The methodology of the study consisted of four phases. Phase 1 is literature review of medical device related incident reports. Phase 2 is the evaluation of the medical devices Compliance Exchange Form (CEF) received by the medical device directorate unit. Phase 3 is a gap analysis between current Standard Operating Procedures (SOPs) of the competent authority and international standards. Phase 4 is the development and dissemination of the risk management plan.

The objectives of the study were the following:

i. Identify the perspective of end-users regarding medical device reporting.

ii. Evaluate and develop a database for the Compliance Exchange Form (CEF).

iii. Assess the protocols used by a medical device unit of the competent authority in handling and processing received incident reports.

iv. Develop a risk management plan for early detection and reduction of risks involving medical devices based on competent authority standard operating procedures, and Medical Devices Regulation (EU) 2017/745 (MDR).

2.2 Ethics Approval

The application and submission for ethics approval was done on 9th April 2022. The status ‘acknowledged’ was received on 3rd May 2022 through email and ethics portal. Application number is registered as MED-2022-00082 with Faculty of Research Ethics Committee (FREC) of the Faculty of Medicine and Surgery (Appendix 1).

2.3 Research Setting

The study was conducted at Malta Medicines Authority (MMA), specifically at the Medical Devices and Pharmaceutical Collaboration (MDPC) Directorate. Three members representing the medical device directorate were invited and included for a focus group discussion relating to the gaps with the current SOP and other areas of vigilance within the directorate. The person-in-charge for medical device incident reports was invited to participate in the pilot implementation of the risk management plan.

2.4 Research Design

The study utilised a qualitative approach which is a method that employs interrogation of the existing variables, making new distinction from different types of occurrence, coining new concepts, and discovering new factors from observations and gathered data (Aspers and Corte, 2019; Small, 2021). Interview, focus group, and/or observation are the main methods applied in this research. The recruitment for this method is purposive, inviting members representing the directorate, to obtain data that is appropriate to the aims of the research (Denny and Weckesser, 2022).

Figure 2.1 summarises the method that was followed for the research.

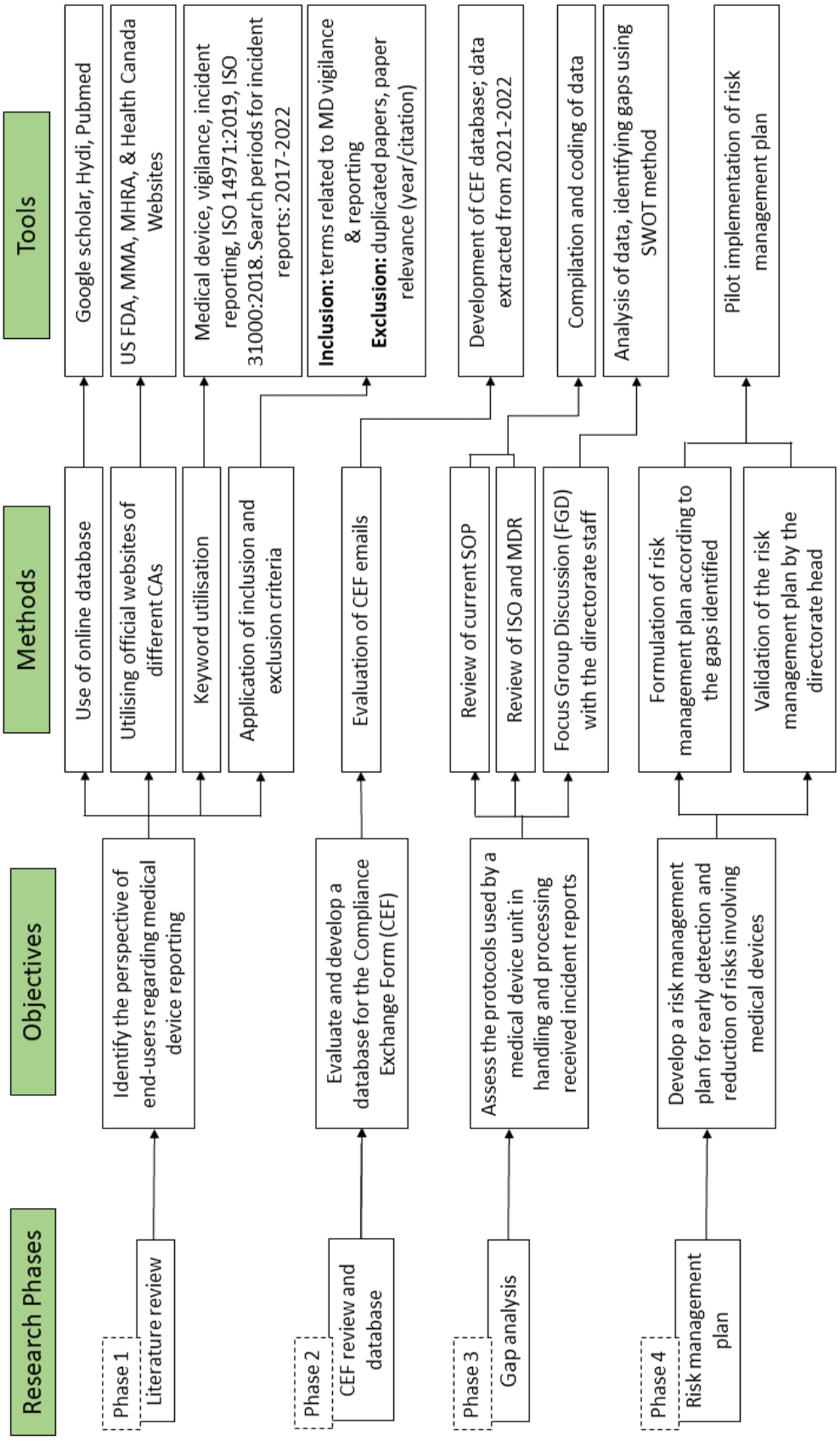


Figure 2.1 Research Phases, Methods, and Tools

2.4.1 Phase 1. Literature Review

Literature review was conducted with the aim of gathering information about the perspective of end-users regarding use of medical devices, and reporting incidents. Electronic search engines such as Hydi, Google Scholar and Pubmed were utilised. Search terms include medical device vigilance, incident reporting, medical device recall, medical device recall case study, medical device recall news and related terms while utilising boolean operators. Date of publication was filtered according to the nature of the search topic. Inclusion and exclusion criteria were determined to refine search results. Journals that are peer-reviewed, published in English, available as full-text online, accessible, and contain data that are in line with the study were included. Duplicated papers and unrelated journals were filtered out. The search data filter for the medical device incident reporting aspects were set from 2017 to 2022.

2.4.2 Phase 2. Compliance Exchange Form Database

A database for the Compliance Exchange Form within the Malta Medicines Authority Medical Devices and Pharmaceutical Collaboration Directorate OneDrive was developed and utilised to gather CEF data from 2021 to 2022. Years 2021 and 2022 were focused on as they contain the complete records of CEF received per year upon the development of the database.

2.4.3 Phase 3. Gap Analysis

Gap analysis was conducted to identify any gaps that may be existing between the SOP of the competent authority and established standards. ISO 1497:2019 [50], ISO 31000:2018

[50] International Organisation for Standardisation (ISO) [Internet]. ISO 14971:2019. Medical devices — Application of risk management to medical devices. Geneva: ISO Annual Meeting; 2019

[51] and, Regulation (EU) 2017/745 [52] were the standard documents reviewed. Medical device document guidelines from the EC website [53], and the incident report form for healthcare professionals and general public available from the MMA website were reviewed. The results from the initial gap analysis between the SOP of the directorate, ISO documents and the Regulation were used as topics for the focus group discussion (FGD) with the three representatives from the MDPC Directorate. The FGD was conducted through a Microsoft Team call/video conference. The participants verbally approved the audio recording and data collection of the discussion. The data recorded was transcribed and processed to be translated into a document. The FGD questions were divided into four parts. Part 1 is about incident reporting and gaps within the directorate, part 2 asks about risks of vigilance within the directorate, part 3 is withdrawals and/or recall issues and procedures, and part 4 is the decision making of a directorate like MDPC and the risks that go along with it. Data extracted from the FGD were analysed by theme and was arranged following the Strengths, Weaknesses, Opportunities, Threats or SWOT analysis. The SWOT analysis table showed the gaps that were identified from the FGD. Results from SWOT analysis was used to develop strategies, such as the development of the risk management plan, in reducing the gaps identified (Helms and Nixon, 2010).

[51] International Organisation for Standardisation (ISO) [Internet]. ISO 31000:2018. Risk management - Guidelines. Geneva: ISO Annual Meeting; 2018.
[52] EUR-LEX Europa [Internet]. Luxembourg. C2017 [cited 2023 May 31]. Regulation (EU) 2017/745 of the European Parliament and of the Council of 5 April 2017. Available from: https://rb.gy/mlsex6
[53] European Commission [Internet]. Brussels: European Commission; c2023 [cited 2023 May 31]. Available from: https://commission.europa.eu/index_en

2.4.4 Phase 4. Risk Management Plan

A risk management plan was developed with the guidance of Medical Devices Regulation (EU) 2017/745 (MDR)[54], SOP of Medical Devices and Pharmaceutical Collaboration (MDPC) Directorate, and results from the gap analysis in Phase 3. The risk management plan went through review and approval by the head of the MDPC Directorate. For the pilot implementation, the person-in-charge for receiving incident reports was invited to use the developed risk management plan for the risk assessment of the incident reports. The risk assessment was designed to be part of the directorate's SOP in determining the risk criteria of an incident prior to the start of any investigation. Ten recent incident reports received by the unit between March 21 to April 20 2023 were evaluated and scored using the risk assessment matrix (Appendix 2). The risk category was determined based on the risk score obtained.

[54] EUR-LEX Europa [Internet]. Luxembourg. C2017 [cited 2023 May 31]. Regulation (EU) 2017/745 of the European Parliament and of the Council of 5 April 2017. Available from: https://rb.gy/mlsex6

Chapter 3

RESULTS

This chapter presents the data and results of the study conducted.

3.1 Incident Reporting in Medical Devices

Literature review searches for medical device incident reports, patient reporting, medical device vigilance and vigilance risk were conducted for Phase 1. Medical device incident reporting, patient reporting, medical device vigilance, vigilance risk, vigilance barriers, underreporting and medical device safety topics were considered. Hydi and Pubmed databases were used as search engines to generate results. Peer-reviewed articles, open access articles, and full articles from 2017 to 2022 were included. Table 3.1 shows the eight barriers that were identified from the literature search.

Table 3.1 Barriers in reporting incidents related to medical devices

BARRIERS	REFERENCE (AUTHOR AND YEAR)
Lack of awareness or education about reporting	Palojoki et al., 2019 Shukla et al., 2020 Choi et al., 2021 Johan et al., 2022 Crunden et al., 2022
Workload and time constraints	Blankholm and Hansson, 2020 Dong et al., 2020 Choi et al., 2021 Crunden et al., 2022
Incident is deemed non-reportable/ non-serious/ not patient-related	Deipolyi et al., 2017 Blankholm and Hansson, 2020 Crunden et al., 2022 Johan et al., 2022
Perception of consequence	Blankholm and Hansson, 2020 Choi et al., 2021 Crunden et al., 2022
Lack of reporting system	Deipolyi et al., 2017 Lahiry et al., 2019
Non-reporting culture	Craig et al., 2019 Johan et al., 2022
Failure to recognise incident	Craig et al., 2019 Danielis et al., 2021
Blame culture and financial disincentives	Crunden et al., 2022

Based on the literature review, eight major barriers that affect incident reporting of medical devices were identified from the references (Table 3.1). These barriers are illustrated in the Figure 3.1.

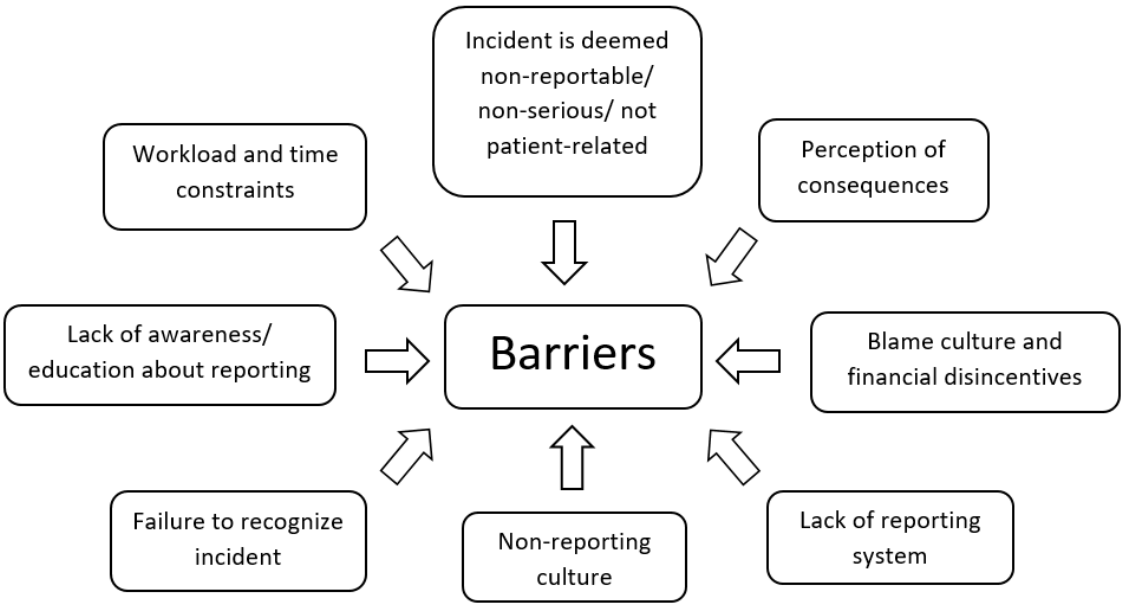


Figure 3.1 Barriers in reporting medical device incidents

3.1.1 Lack of Awareness and Education

End-user's lack of knowledge and awareness about reporting incidents related to medical devices affects how incident reports are recorded and investigated. The lack of knowledge about reporting procedures, familiarity with the protocols and possibility of actual reporting are the underlying reasons (Palojoki et al., 2019; Shukla et al., 2020). Another possible cause is the absence of training for end-users and stakeholders about reporting, fostering a sense of responsibility and deficiency in awareness on what, how and where to report medical device incidents (Evans et al., 2006).

3.1.2 Workload and Time Constraints

Underreporting of incidents corresponding to medical devices can be connected to the overwhelming work schedule and high workload of the healthcare professionals. The incident reporting itself is deemed to be time consuming and burdensome. There is no difference regarding saving time in reporting between using manual or paper and electronic forms; both are still considered time consuming (Aljabari and Kadhim, 2021). A hectic and busy clinical environment, lack of time to report, and length of time needed to fill-in the report procedures lead to underreporting (Crunden et al., 2022).

3.1.3 Underrating the Incident

Assessment of the importance of the incident is a barrier in reporting. In a study by Johan et al. in 2022, reporting of burn incidents related to MRI scans are rare despite the frequency of occurrence suggesting a lack of understanding in necessity of reporting such incidents. Downplaying the frequency of events implies that the incident is normal and is not a cause to submit a report which creates a barrier in vigilance of medical devices (Crunden et al., 2022). Medical device incidents and equipment fault involving staff is often undocumented or unregistered which leads to barrier in medical device vigilance (Blackholm and Hansson, 2020).

3.1.4 Perception of Consequences

The fear of consequences after reporting an incident creates a barrier for incident reporting. Healthcare professionals, in some cases, overemphasise any event that may be considered as an incident which leads to low receptivity for actual incidents. A notion that the healthcare provider that reported the incident becomes the responsible person for the development and control of the incident creates an uncertainty in reporting (Crunden

et al., 2022). In a study by Mohamed et al. in 2021, 13% of the physicians that completed the survey say that the fear of retaliation from reporting is a barrier. The same survey revealed that participants were less likely to submit an incident report when a colleague (63%) or themselves (46%) are incriminated in the incident.

3.1.5 Lack of Reporting System

The lack of utility of reporting or a system in place for reporting is a common reason for not reporting incidents (Deipolyi et al., 2017). Without a system in place, reporting is hindered by an unknown acceptable level of device error. In some institutions, the standardisation of error level is absent thus each reporter becomes reluctant if the incident is to be reported or not. Similar to other identified barriers, the inefficiency of a reporting system in place affects the turn-around-time of the reporting (Tase et al., 2022).

3.1.6 Non-Reporting Culture

The non-reporting culture has stemmed from previous issues with the reporting system. Underlying reasons are lack of effectiveness of reporting methods and no quality improvements seen after reporting (Tase et al., 2022). The negative experience has cultivated into a general acceptance that reporting does not result in any changes thus creating a culture that does not promote reporting incidents.

3.1.7 Failure to Recognise Incident

Failure to acknowledge the relationship of a medical device with on-going incidents can be traced back to different factors such as appearance of a new complication relating to medical device use, gap between the emergence of symptoms and intervention with the device, non-specific or non-related patient evidences, lack of knowledge about the known adverse effects, and lack of awareness of the preceding intervention performed due to

variation of healthcare staff performing the method (Craig et al., 2019). The inability to recognise the source of the incident, be it a device, human error or process error, is also a barrier in reporting (Tase et al., 2022).

3.1.8 Blame Culture and Financial Aspect

Blame culture in the healthcare setting is still prevalent despite the constant reminders of existing protocols on safety and collaborative comprehension from incidents. Years of repetitive blaming practices have hindered reporters from submitting reports. In connection to that, some institutions link reporting of incidents to funding. Increase of reports can potentially translate to decrease preventive measures thus reduction of funding. Submitting a report shifts the attention from learning to blaming the reporter and his/her ability to perform and prevent incidents (Crunden et al., 2022). The focus on directed blame, instead of acknowledging personal responsibility, is shown to contribute to the lack of reporting and varies depending on the incident type, factors of contribution involved, and severity of harm to the patient (Cooper et al., 2017).

3.1.9 Recommendations to Reduce Barriers of Reporting

The following recommendations to reduce barriers in reporting incidents with medical devices were identified from the literature review: education and training of end-users in reporting, feedback in reporting, system transparency, climate of openness, establishing reporting system, and inclusion of a pharmacist in patient interview and history taking (Figure 3.2).

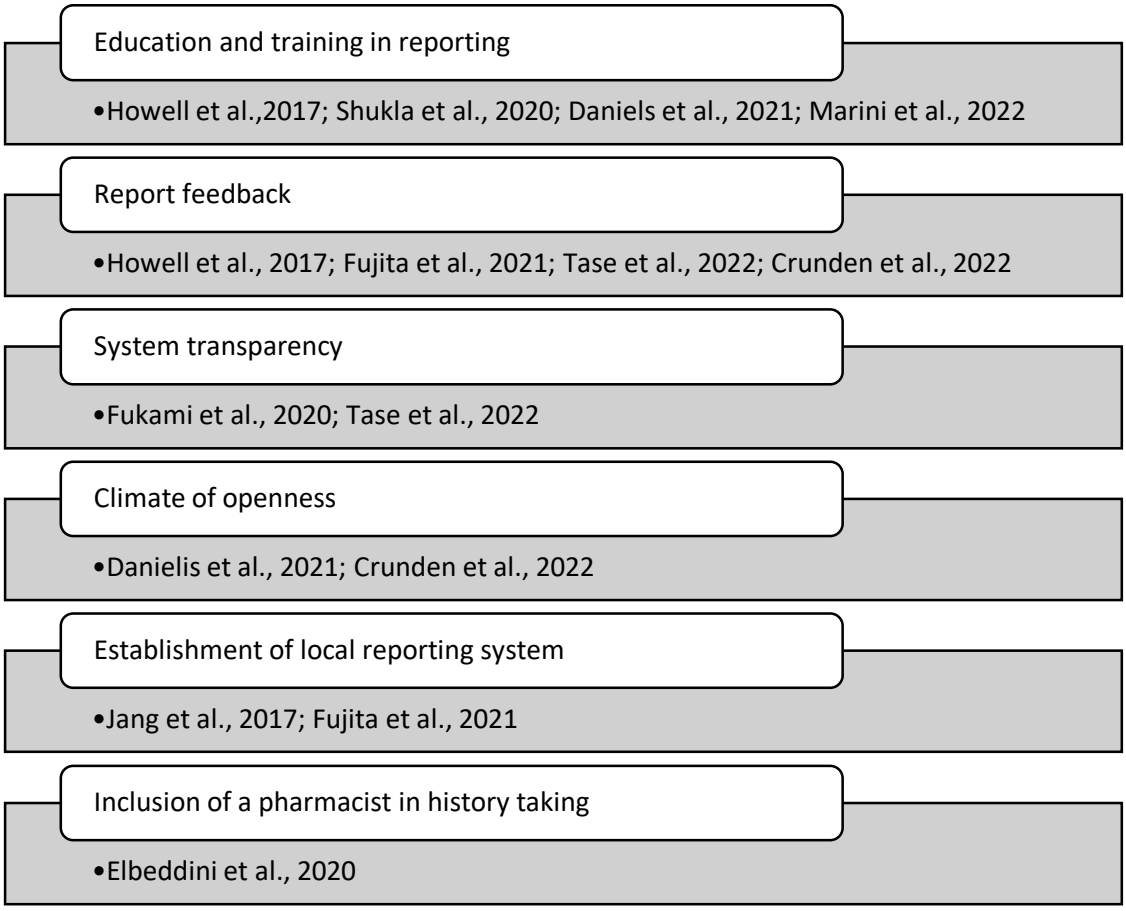


Figure 3.2 Recommendations for reducing barriers to incident reporting

3.1.9.1 Education and Training in Reporting

Healthcare professionals should be educated that reporting does not entail legal repercussions to address the reluctance of reporting. Their role in vigilance should be acknowledged. Raising awareness by distributing technical documents would help with the sustainability of the reporting system (Shukla et al., 2020). Widespread and continuous training regarding identification and investigation of incidents increases the value of the reporting system (Howell et al., 2017; Marini et al., 2022).

3.1.9.2 Report Feedback

Feedback is a crucial element of a reporting system and an integral part of learning from error (Howell et al., 2017). Providing feedback on submitted reports supports better communication with other stakeholders and the reporter (Tase et al., 2022). Enhancing the feedback system for the reporters may result in voluntary in-hospital reporting of minor cases (Fujita et al., 2021).

3.1.9.3 System Transparency

Efforts directed at improvement in patient safety and healthcare includes transparency of the reporting system (Fukami et al., 2020; Tase et al., 2022). Updating the medical device reporting program as one of the methods used to monitor device status and safety concerns is an important step towards transparency and proactive vigilance.[55]

3.1.9.4 Climate of Openness

The level of openness in communication and team cohesion were directly related to increase in reporting. This behavioural modification and adaptation to responses influenced better documentation of incidents in the healthcare setting and reduces the apprehension of consequences for the healthcare provider (Yu et al, 2022). The climate of openness and absence of fear in disclosing details opens the opportunity for staff and healthcare providers to learn from events and enhance healthcare practice, and promote culture of incident reporting (Danielis et al., 2021; Crunden et al., 2022).

[55] U.S. Food and Drug Administration [Internet]. Maryland. C2019 [cited 2023 March 17]. Statement on agency's efforts to increase transparency in medical device reporting. Available from: https://www.fda.gov/news-events/press-announcements/statement-agencys-efforts-increase-transparency-medical-device-reporting

3.1.9.5 Establishment of Local Reporting System

The effectiveness of reporting incident reports, implementation of safety of medical devices and monitoring adverse events is directly connected to the initiation of local information reporting system for medical device safety (Jang et al., 2017). Developing such a system can assist in examining complications and incidents on a national-level and promotes mandatory communication of serious adverse incidents with top-level legal risks (Fujita et al., 2021).

3.1.9.6 Inclusion of Pharmacist in History Taking

Pharmacists hold a unique skill set in assisting patients manage medicines and medical devices' use. The skill and knowledge to evaluate appropriate use of medicines and devices place pharmacists in a crucial role towards vigilance. Setting up a database that includes the role of a pharmacist enables better reporting of incident reports (Dall'Aglio et al., 2012; Toklu and Mensah, 2016). Inclusion of pharmacists in the leadership team that conducts the Best Pharmacists Medical History or BPMH is an effective way in extracting information from patients regarding potential adverse events or medical device incidents (Elbeddini et al., 2020).

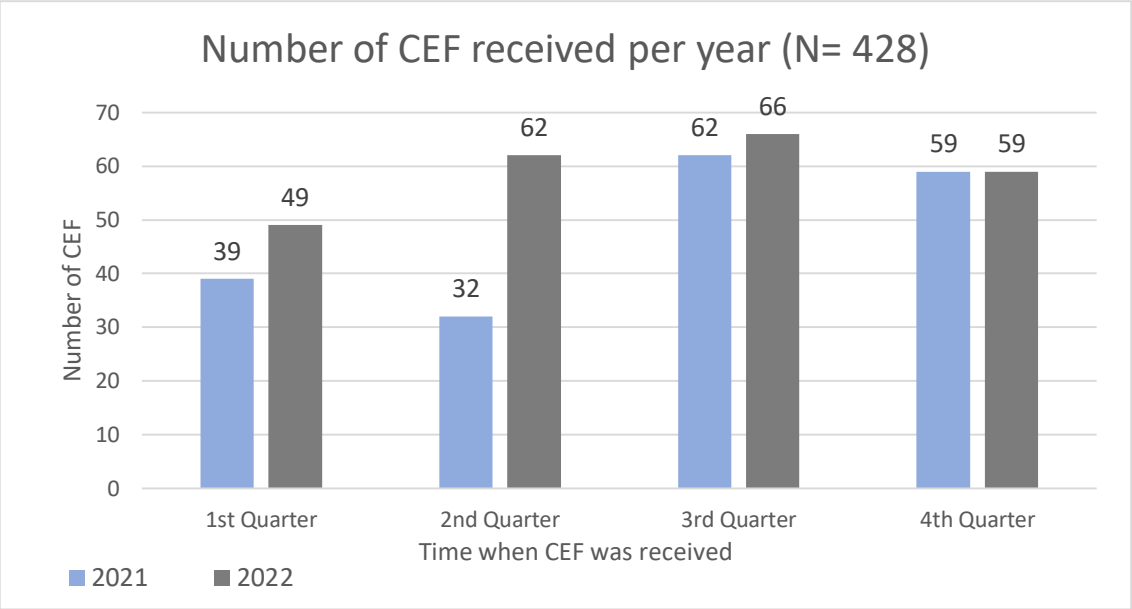
3.2 Compliance Exchange Form Database

The Compliance Exchange Form (CEF) database was developed with the OneDrive of the Medical Devices and Pharmaceutical Collaboration (MDPC) Directorate for Phase 2. The database contained headings reflecting the CEF format and other important information for a cohesive tracking. Each CEF compiled was arranged according to the initial date of circulation. The headings are colour-coordinated into 5 different parts.

Part 1 contained primary data such as initial date of circulation, CEF reference number, and purpose of information. Part 2 contained the main data such as originating CA, NB, or DA being asked for assistance or approached, name or trade name of medical device, manufacturer of medical device, availability of device, subject or background of the information, and specific assistance being requested. Part 3 contained data regarding the responder or any EU member state that responds to the initial information. This part contained the name of the responding CA, NB or DA, date of response, and details of response. The fourth part detailed the summary supplied by originating CA. Part 5 displayed the current status of the information or inquiry, open or closed, and any comments or notes from the researcher that are deemed important.

CEF related emails received by the official email address of the directorate were forwarded to the researcher and are compiled using the database. CEFs concerning Malta were highlighted for easier identification and tracking. A separate folder is being kept in the Microsoft Teams file sharing folder of the directorate regarding CEFs initiated by Malta. The CEFs from 2021 to 2022 were included in the study as the compiling system of the database was complete during these two years. Other CEFs were included in the database from previous years for documentation and archiving purposes. The CEFs from 2023 were documented but were not included in the study as they are on-going and are incomplete.

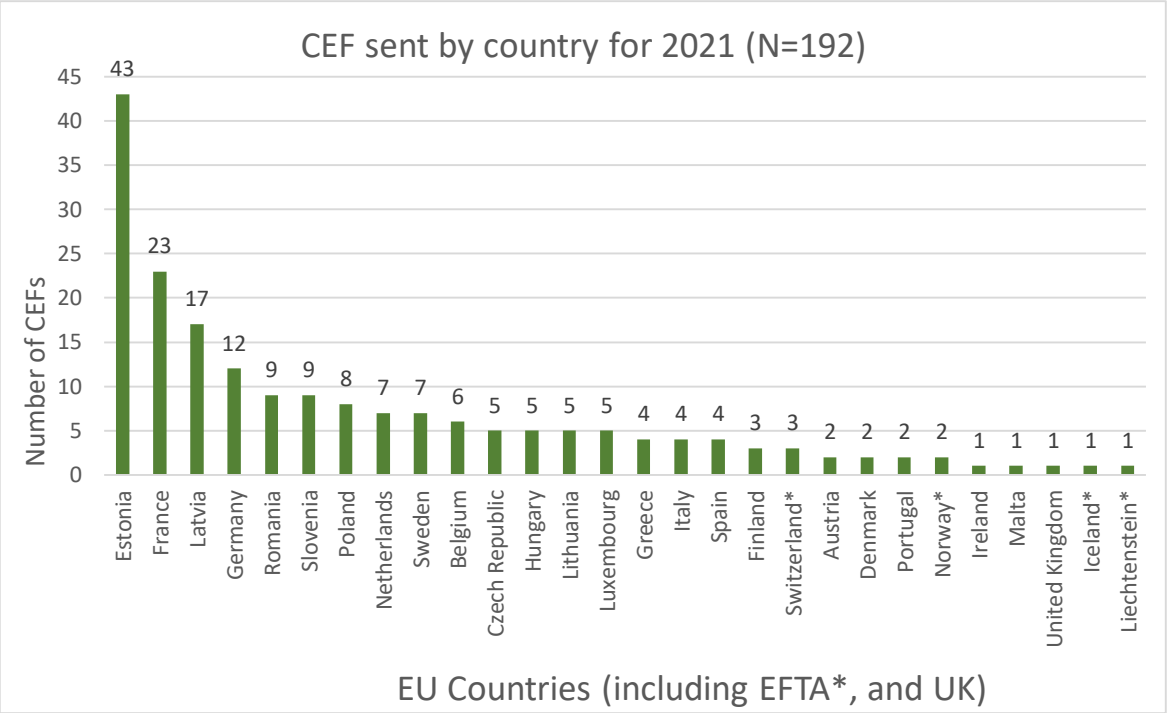
Figure 3.3 shows the initial CEF received from 2021 to 2022, which were extracted from the developed database, and are arranged per quarter. There were 192 CEFs in 2021 and 236 CEFs in 2022 which totals to 428 CEFs.



Adapted from: Compliance Exchange Form database of Medical Devices and Pharmaceutical Collaboration Directorate of Malta Medicines Authority.

Figure 3.3 Compliance Exchange Form received from 2021 (n=192) and 2022 (n=236) (N=428)

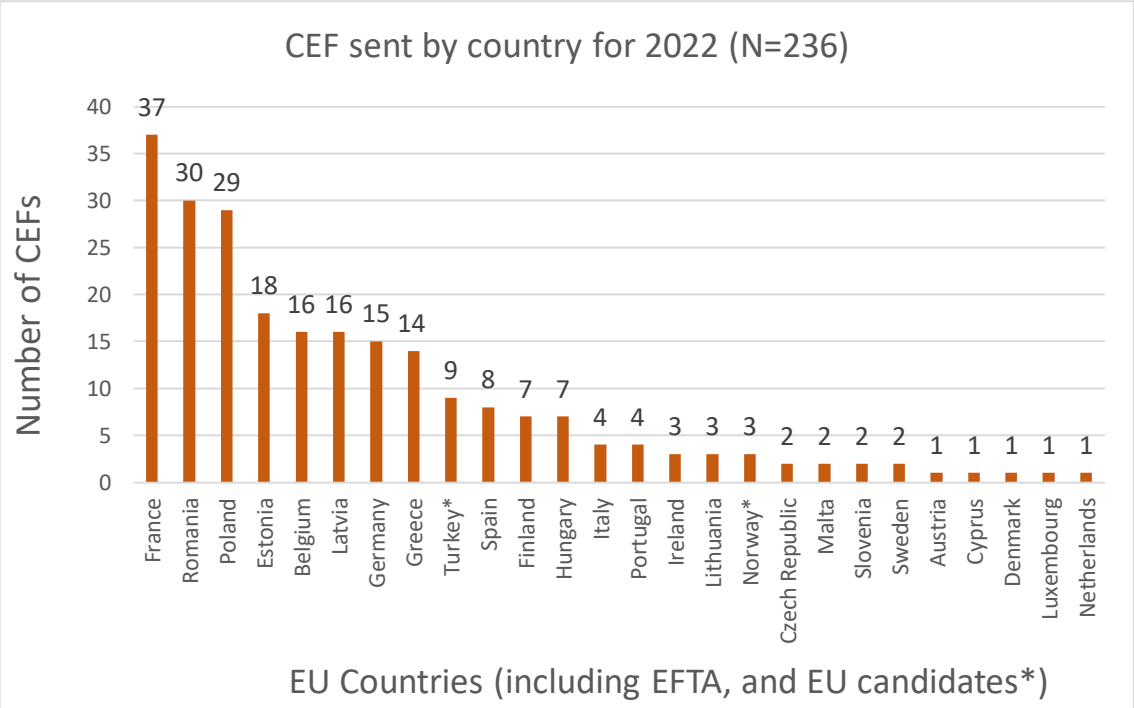
Figure 3.4 shows the CEF sent by EU member states in 2021 (N=192) from the developed database. The country with the highest initial CEF sent is Estonia (n=43), followed by France (n=23), Latvia (n=17), Germany (n=12) and Romania and Slovenia (n=9 each country). Other countries included in the graph were Poland (n=8), Netherlands (n=7), Sweden (n=7), Belgium (n=6), Czech Republic (n=5), Hungary (n=5), Lithuania (n=5), Luxembourg (n=5), Greece (n=4), Italy (n=4), Spain (n=4), Finland (n=3), Austria (n=2), Denmark (n=2), Portugal (n=2), Ireland (n=1), and Malta (n=1) arranged by decreasing order. Initial CEFs sent by countries from the European Free Trade Association (EFTA) such as Switzerland (n=3), Norway (n=2), Iceland (n=1) and Lichtenstein (n=1) were included. Initial CEF sent by the United Kingdom (n=1), post-Brexit, were still included in the database.



Adapted from: Compliance Exchange Form database of Medical Devices and Pharmaceutical Collaboration Directorate of Malta Medicines Authority.

Figure 3.4 Compliance Exchange Form sent per country for 2021 (N=192)

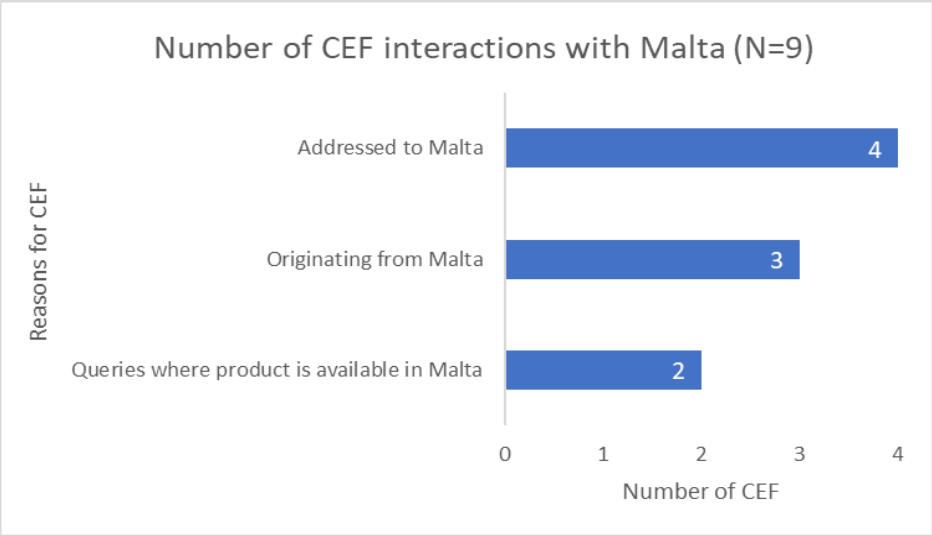
Figure 3.5 shows the initial CEF sent by EU member states in 2022 (N=236) from the database. The country with the highest number of initial CEF sent is France (n=37) followed by Romania (n=30), Poland (n=29), Estonia (n=18), and Belgium and Latvia (n=16 for each country). Other EU member states included in the graph were Germany (n=15), Greece (n=14), Spain (n=8), Finland (n=7), Hungary (n=7), Italy (n=4), Portugal (n=4), Ireland (n=3), Lithuania (n=3), Czech Republic (n=2), Malta (n=2), Slovenia (n=2), Sweden (n=2), Austria (n=1), Cyprus (n=1), Denmark (n=1), Luxembourg (n=1), and the Netherlands (n=1) arranged by decreasing order. From the countries of the European Free Trade Association, Norway initiated 3 CEFs in 2022. The data included the initial CEF sent by Turkey (n=9) which is an EU candidate country.



Adapted from: Compliance Exchange Form database of Medical Devices and Pharmaceutical Collaboration Directorate of Malta Medicines Authority.

Figure 3.5 Compliance Exchange Form sent per country for 2022 (N=236)

Figure 3.6 shows the number of CEF involving Malta for 2021 to 2022 as extracted from the database. Four CEFs were addressed to Malta from Estonia, Latvia, and Ireland. The background of these queries involve suspected violation of a certain medical device, inefficient information provided for the medical device, and inquiry regarding management of certificate of notifications from NBs. Three CEFs were sent by Malta to all EEA states. The forms included inquiry for failure rates of a certain medical device and opinions for a specific medical device effectivity. The 2 CEFs from Denmark and France were about medical devices that are available in other EU member states including Malta.



Adapted from: Compliance Exchange Form database of Medical Devices and Pharmaceutical Collaboration Directorate of Malta Medicines Authority.

Figure 3.6 Number of Compliance Exchange Form involving Malta (N=9)

3.3 Gaps in Vigilance

Awareness of subtle signs and deterioration are important in vigilance (Rahimi et al., 2017). Under-reporting is one of the gaps identified for medical device vigilance (Qouhafa et al., 2021).

3.3.1 Vigilance SWOT Analysis

The focus group discussion consisted of the three members representing the MDPC Directorate for Phase 3. Each member was asked with guide questions to identify gaps in medical device vigilance (Appendix 3). The identified gaps were arranged by theme using the SWOT matrix (Table 3.2).

Table 3.2 SWOT Analysis of the Gaps Identified

STRENGHTS	WEAKNESSES
QUALITY. Well-developed and tailored SOP that fits current practice **ADAPTIVE**. Adapts a process that works for a smaller state like Malta. Adapts to changes whenever needed. **STRAIGHTFORWARD**. Direct communication with stakeholders which results to quicker response, investigation, and resolution of issues. **HARMONIZED**. Advisory committee is present and is available for consultation. Good relationship with other stakeholders. **COMPLIANT**. Excellent compliance with the standards required by the legislation and regulation **INNOVATIVE**. Current action timelines follow a quicker pace versus that of the MDR.	**IN DEVELOPMENT**. SOP and its risk analysis are currently at the drafting stage **FREQUENCY OF CHANGES**. Small and frequent changes with parts of the process algorithm might result to pending incident reports **UNFILTERED**. All types of reports are received, including procurement-related reports
OPPORTUNITIES	**THREATS**
TIMEFRAME. Specific timeframe may be added in each step of the SOP to improve overall turn-around time. **TRIAGE SYSTEM**. Solidification of a triage system with an active filtering of emails may contribute to reduction of unrelated reports **PROMOTION**. Encouragement of incident reporting and educating end-users of when, how and where to report incidents related to medical devices to reduce risk of harm.	**UNDER REPORTING**. Under reporting and lack of awareness about the reporting system might result to patient harm.

Table 3.2 shows the gaps identified from the focus group discussion. The strengths of vigilance with the directorate included having a well-developed and tailored SOP that fits the current practice, adapting a process that works for a smaller state like Malta and maintaining flexibility to changes when needed. The directorate sustained a direct communication with stakeholders which resulted to quicker response time, investigation and resolution of issues, and an advisory committee was present and was accessible for consultation. The directorate showcased a good relationship with other stakeholders, maintained an excellent compliance with standards required by the legislation and regulation, and the action timelines followed at the time of the research have quicker pace versus that of the MDR. The weaknesses identified were related to the SOP document

and its risk analysis which, at the time of the focus group discussion, were still at the drafting stage. The small changes applied to the everyday procedure for adaptability may also be a weakness as it could result to more pending incident reports for investigation. The directorate received all types of email including procurement-related issues which might have pushed back important emails and was considered a weakness for vigilance. The opportunities were as follows: a specific timeframe may be established with each step of the SOP to improve overall turnaround time, solidification of a triage system with an active filtering of emails may contribute to the reduction of unrelated emails, and encouraging incident reporting and educating end-users of when, how and where to report incidents related to medical devices can reduce risks of harm. The potential threat is the under-reporting and lack of awareness about the reporting system which may then lead to patient harm.

3.4 Risk Management Plan

The development of the risk management plan (Appendix 2) for Phase 4 included data gathered from the gap analysis in Phase 3 and review of the current SOP. The risk management plan was designed to be performed in the first part of the directorate's SOP as part of the risk analysis process.

Figure 3.7 shows the outline of the developed risk management plan.

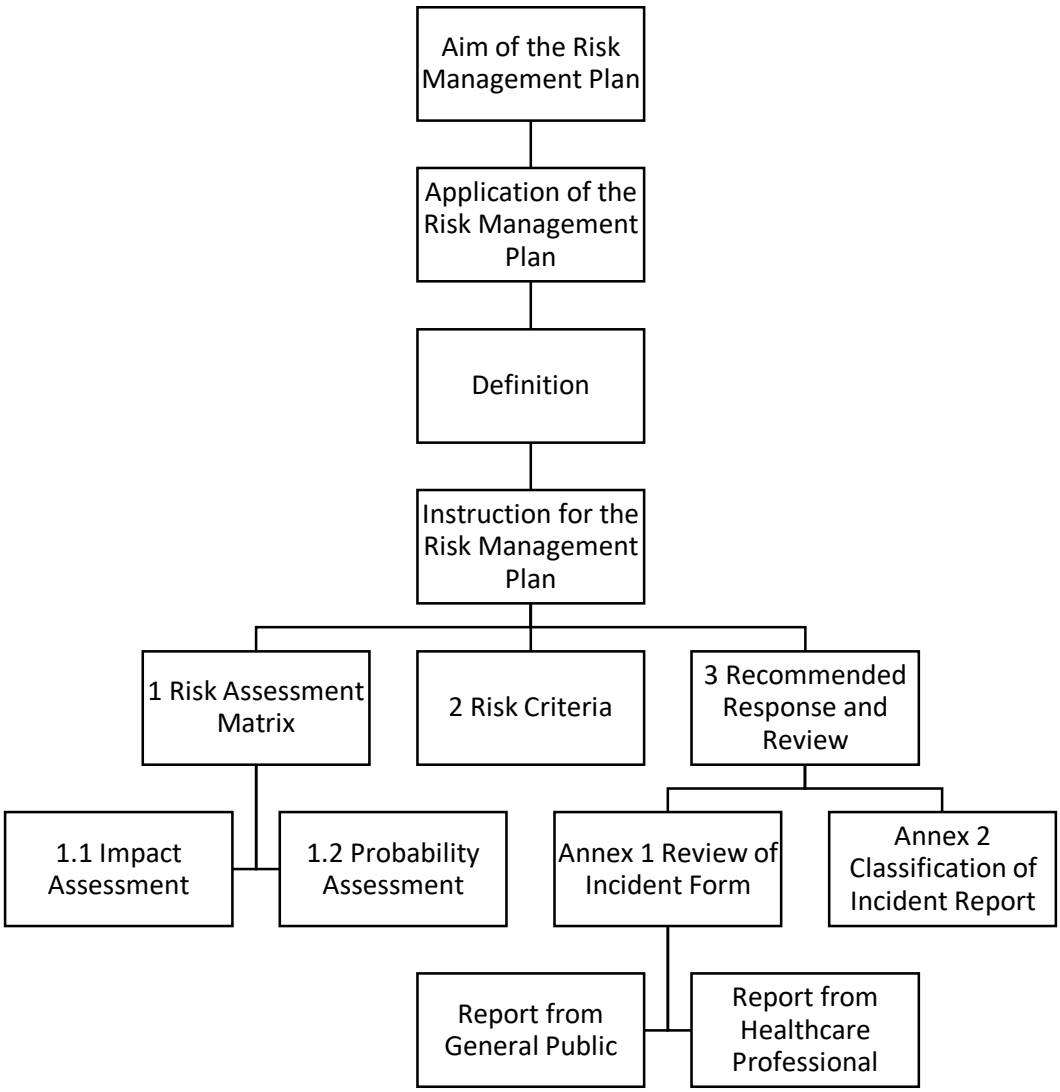


Figure 3.7 Outline of the Risk Management Plan

Figure 3.7 shows the outline of the risk management plan that was developed. The risk management plan (Appendix 2) contained four major parts. The first part is the aim of the risk management plan which is to assess the risk of each medical device incident report received by the Directorate. Secondly, there is the application of the risk management plan which is to contribute to the continuous efforts of ensuring patient safety and further improvement of medical device vigilance. The application of the document pursues the enhancement of turnaround time in handling medical device incident reports, refinement of definitions of risks and levels of risks, and mitigation of risks associated with medical

device incident reports received by the Directorate. The third part is the definition for impact and probability while the fourth part included the majority of the content of the risk management plan. The instructions section is further divided into three points where point one and point three have subheadings.

Under the instructions section, five tables are located which contain the risk matrix, and recommendations. Appendix 2 (Table 1) is the risk assessment matrix which contains the impact of the incident report and probability. The impact is scored from 1-5 where 1 is insignificant and 5 is extreme. The probability can be scored from 1-5 where 1 is improbable and 5 is frequent. Part 1 is further divided into table 1.1 and 1.2, where the former is the impact assessment and the latter is the probability assessment. The impact assessment table contains the definition for each impact point. Insignificant is defined as no or minimal adverse effect on person's health, or improbable to result in adverse regulatory response or action while extreme is when there is death or permanent disability, event has a potentially disastrous impact, severe injury or illness occurred, or extreme stress that leads to inability to perform work duties in the foreseeable future. The probability assessment table contains definitions for each probability point. Improbable is defined as very unlikely to cause harm where there is less than 1 in a million chance of occurring while frequent is defined as expected to cause harm in most circumstances or the odds of causing harm is 1 event per 1000 uses.

Appendix 2 (Table 2) is the risk criteria where different criteria equate to different risk criteria scores based on the risk assessment matrix. Risk criteria 20-25 is labelled as 'extreme risk' where the risks remarkably exceed the allowable tolerance and requires urgent attention. Risk criteria 10-16 is 'high risk' where the risks exceed the risk allowable threshold and needs a proactive approach. Risk criteria 5-9 is 'moderate risk'

where the risks are within admissible threshold and require on-going monitoring. Risk criteria 1-4 is labelled as ‘low risk’ where risks are beneath the acceptable threshold and do not prescribe active management. Appendix 2 (Table 3) is the recommended response and review where each risk criteria contains a recommended initiation time frame according to the existing SOP. Extreme risk and high risk is recommended to initiate procedure or investigation within 24 hours, moderate risk within 48-72 hours and low risk is within 7 days.

3.4.1 Approval of the Risk Management Plan

The review and approval of the risk management plan was done by the head of the MDPC directorate. The final version of the risk management plan was saved after the review and approval.

3.4.2 Pilot Implementation of the Risk Management Plan

The final version of the risk management plan was used for the pilot implementation. Ten recent incident reports received by the unit between March 21 to April 20 2023 were used for the risk management plan. Each of the incident reports was reviewed and scored by the person-in-charge according to the risk assessment matrix found in the risk management plan (Appendix 2). An excel spreadsheet was prepared to record the risk score and risk category.

Table 3.3 shows the quantity of the source of the incident reports used for the pilot implementation.

Table 3.3 Quantity of Incident Report per Source

Location	Number of Incident Reports
Mater Dei Hospital	8
Gozo General Hospital	2

Table 3.3 shows the quantity of incident reports received from the 2 hospitals in Malta March 21 to April 20 2023. Eight out of 10 of the incident reports used for the pilot implementation were from Mater Dei Hospital (MDH) and 2 out of 10 were from Gozo General Hospital (GGH).

Table 3.4 shows the results from the pilot implementation of the risk management plan. Each of the 10 incident reports were assessed by the assessor from the medical device directorate and a score was assigned based on the risk matrix (impact x probability). Incident reports 1, 2, 3, 5, 7, and 9 have scores between 1-4 meaning they are low risk. Incident reports 4, 6, 8, and 10 have scores between 5-9 meaning they are moderate risk.

Table 3.4 Risk Score and Risk Criteria of the Evaluated Incident Reports

Incident Report	Risk Score	Risk Criteria
1	1	Low Risk
2	2	Low Risk
3	4	Low Risk
4	9	Moderate Risk
5	1	Low Risk
6	6	Moderate Risk
7	4	Low Risk
8	6	Moderate Risk
9	2	Low Risk
10	6	Moderate Risk

Chapter 4

DISCUSSION

4.1 Vigilance in Medical Devices

Medical devices are an important development for healthcare. The safety of use and application of medical devices are vital for the modern clinical routine. Understanding how medical devices can cause harm are pivotal in promoting safety for its end-users. In an incident where the medical device fails, malfunctions, or does not perform accordingly, reporting plays a key role in ensuring that any risks are reduced and minimal to no harm is experienced for the end-users. It is the professional obligation of healthcare professionals and providers to report any incidents relating to medical devices. The obligation entails the cooperation with the higher federal authority for the investigation, risk management process and corrective measures needed to ensure overall safety. Other stakeholders such as manufacturers, operators, and other distributors are endowed with such responsibility (von Mallek, 2015).

In vigilance, reporting is an important method to ensure that the medical devices in the market are safe and are performing with the expected safety after it was released for public use. Thus, any barriers to reporting could mean a risk in the vigilance system. Under-reporting is a multi-factorial problem which could be a result of generations of practices in the healthcare environment and its providers. From the literature review search conducted, barriers in reporting have been identified (Figure 3.1). Lack of awareness and education from the end-user's side greatly affects how authorities document incident reports. The lack of understanding why reporting is important limits the full scope and application of vigilance in post-marketing (Evans et al., 2006; Palojoki et al., 2019; Shukla et al., 2020). In a study performed in India, only 9.8% of doctors and 26.1% of nurses were aware about the reporting system. The main issue is the lack of knowledge especially with the younger members of the healthcare team about the local reporting

system available and how to utilise such system (Singh et al,2018). The dental healthcare setting is facing a very similar situation. The study identifying barriers in incident reporting showed that 63% of the participants from the dental industry are aware of the incident reporting procedures yet only 35% affirmed of completing an incident reporting form prior, which may indicate that participants do not utilise the available reporting system. Fifty-nine percent of the participants reported that most of the time, the incident is only verbally relayed to the management. Documentation of incident reports becomes the last priority and most of the time these incidents are forgotten and not investigated. Only 67% of the participants agreed that it is necessary to report resolved incidents, and 25% stated that they have encountered one to two incidents but were not reported (AlBlaihed et al., 2017).

From a cross-sectional study, 64% of the participating nurses were trained to handle medical device injury (needle stick injury) and 20% of the participants experienced the NSI prior to the study, but only 31% of them reported the event to the department manager or director. The principal reasons for not reporting were the complicated and cumbersome reporting protocol (51%), time constraint with workload (49%), and low-risk assessment in terms of personal health (32%) (Dong et al., 2020). Similarly, another cross-sectional study showed 61% rate of under-reporting with NSIs due to busy clinical schedule (42%) and low risk of infection perception (38%). A correlation between occurrence of the injury, working hours and frequency of working hours was found (Jahangiri et al., 2016). The fear of consequence and blame-culture is a factor in the reluctance of healthcare professionals to use incident reporting systems in communicating for the purpose of patient safety. Being at the receiving end of the blame regardless of the situation at the time of the incident creates a barrier for reporting. Only 2% of the reporters acknowledged personal responsibility while 42% of the reports directed the blame at others. Although

the difference does not equate to generalisation of the proportion presented, there is still a substantial gap that needs to be addressed as the goal of the reporting is patient safety and not pointing fingers at colleagues (Cooper et al., 2017).

4.1.1 Recommendations for Risk Reduction

The problem with under-reporting presents a significant risk to the safety of the patient and requires promotion of relevant reporting and risk mitigation. Early detection of the risks could reduce the chance of complaints and incidents through suitable action planning. Figure 3.2 shows recommendations for reducing barriers in incident reporting. Healthcare professionals and other end-users of medical devices should be motivated by the management or the healthcare authorities to proactively report incidents. The importance of reporting an incident should be emphasised and linked to learning, risk mitigation, and implementation of actions accordingly for the prevention of harm. Positive encouragement and fostering a good environment for reporting allows the reporters to have the opportunity to put forward any incident that has occurred without fear of blame or consequences (Turner, 2016; Crunden et al., 2022).

The relationship between reporting rates and quality indicators showed that high rates of reporting were related to a culture of positive safety practices (Hutchinson et al.,2009). Giving feedback with incident reports after investigation or conclusion shows improvement in reporting performance and care delivery system (Benn et al., 2009). Feedback system is an important part of understanding and learning from incidents and harnessing a culture of awareness to safety and acceptance (Ghandi et al., 2005). A qualitative research showed that actions after an incident report such as change of practices, coordination of corrective actions across departments, reinforcement of good practice, goal-setting to reduce particular types of errors, culture of openness, better risk

understanding, and increase in vigilance promotes a better environment for reporting incident and removes the stigma of blame and fear (Lanza et al., 2009; Anderson et al., 2013). Pharmacists take a unique role in identifying and acknowledging incidents (Janusziewicz et al., 2021). They are one of the primary healthcare providers in the community setting and are one of the first responders in terms of incidents. Pharmacist's intervention has an impact in promoting patient care and incident reporting (Leone et al., 2013). Empowering pharmacists in educating the public through promoting reporting for both medicinal adverse events and medical device incidents can affect how the vigilance system is maintained. Efficient incident reporting and active participation of pharmacists can lower safety risk and emphasise the professional role of pharmacists in advancing patient safety (Garrett et al., 2013; Panchal et al., 2022). Expanding the role of the pharmacist by encouraging history taking with medicines and medical devices can pave the way to better medical device use and prevention of incidents.

4.2 Compliance Exchange Form Database and Documentation

The Compliance Exchange Form or CEF is a tool of communication between CAs and/or DAs. In specific cases, NBs may be included into the communication based on the information needed. The study developed a database for the CEFs received by MDPC directorate. The database was used as an archiving and monitoring tool to trace and track medical devices that have reports, queries or issues from other EU member states. Through the database, the tracking of different incidents and/or inquiries are harmonised as each CEF received was contained and summarised under the initial date of circulation and the CEF number which is unique to every form. The database reduced the extra time and effort required to track reports or incidents compared to opening and consolidating singular email per event. The database also served as an archive for all of the events that

have occurred from the previous years. A direct approach for searching previous and existing inquiries regarding certain medical devices.

From the data presented in Figure 5 and 6, Estonia (n=43) and France (n=37) had the highest CEF initiated from 2021 and 2022, respectively. The population of Estonia in 2022 categorised the country as a small member state, having a population of less than 3 million (Briguglio, 2016), in comparison to France which has a population of approximately 68 million.[56] With that observation, there is the question of why Estonia managed to initiate a large number of CEF compared to other small member states in the EU. The New Yorker published a journal article in 2017 naming Estonia as a digital republic. The article discussed how most things, such as banking, health records, emergency health services and alike are digitised in Estonia. Software engineers and information technology experts from Estonia are encouraged to work for the government with the aim of continuous improvement of the country's digitalisation era. Promoting a digital and 'borderless country', Estonia pursued technological improvements and start-ups from its citizens, even those who are residing in other parts of the globe.[57] Although, going completely digital does not set Estonia apart from other EU member states as digitalisation is a current worldwide trend in most EU and non-EU countries. A study by Vărzaru in 2022, Poland was categorised with lower digitalisation rates but managed to initiate 8 CEFs in 2021 and 29 CEFs in 2022 (Figure 3.4 and 3.5). By observing this trend, digitalisation has positive effects, especially on the reachability and potential accessibility of health and reporting to its end-users, but is not the absolute answer to incident reporting. Digitalisation should be considered as a tool for risk mitigation and better

[56] European Union [Internet]. Brussels. C2022. [cited 2023 May 01]. Facts and figures on life in the European Union. Available from: https://european-union.europa.eu/principles-countries-history/key-facts-and-figures/life-eu_en

[57] The New Yorker [Internet]. Manhattan. C2017. [cited 2023 May 25]. Estonia, The Digital Republic. Available from: https://rb.gy/33ue0

reporting, not the final solution (Odone et al., 2019). The accessibility and understanding of the importance of reporting should be the primary goal. In line with the topic of reporting, a study comparing crime reporting factors in EU countries showed that the frequency of reporting neither reflects the geographical location of the country nor size. Multiple factors are being considered, including factors that were discussed in the Phase 1 (Table 3.1) of the study. Similarly, provincial and urban culture of the source of the report contributes to the frequency of the reporting (Torrente et al., 2017). A difference in reporting behaviour is also observed between public and private hospitals in France. Regardless of similarity in substance and quality of reporting, public hospitals in France generate a higher reporting rate compared to the private sector. The culture of reporting in public teaching hospitals and regional location could be one of the factors for the difference in which CA initiates CEFs (Altenstetter, 2008). The gravity and the reporter's perception of the incident definitely affects the pursuance of forwarding the report to authorities, in which the similar themes were shown on the results from Phase 1 (Table 3.1 and Figure 3.1).

Germany has initiated 12 CEFs in 2021 and 15 CEFs in 2022 which is above the average number of CEFs received per year. The number of CEF can be related to the experience of post-market surveillance in the country. From the study of Siekmeier and Lütz in 2007, 55% of the reports are from manufacturers of medical devices and 35% are from the Drug Commission of the German Pharmaceutical Association and pharmacies. The system of the country regarding accessibility of reporting, in this case the ability to report to pharmacies, can be linked to their surveillance and number of initiated CEFs. From this observation, proposing a more accessible type of reporting to end-users could potentially assist in a better medical device vigilance.

From the year 2021 to 2022, Malta received nine incoming CEFs and six outgoing CEFs were sent. The topics of the CEFs Malta received included a query about on-going use of a preservative compound, performance of a knee replacement device and skin stapler device, safety regulation of a catheter, result discrepancies from a glucose monitoring device, query for notification procedure, expiration of permit of a medical shunt, and safety regulation violation of a pain relief machine. The involvement of Malta and its good response rate for inquiries showed the valuable help the medical device unit can have with the CEF for other neighbouring member states. In turn, Malta could also benefit from monitoring what medical devices are being questioned by other member states for pre-emptive measures and vigilance.

The database had recorded an increase in initial CEF from 2021 to 2022 from different EU countries as shown in Figure 3.3. The increase can be attributed to the COVID-19 pandemic which required use of medical devices such as personal protective equipment or PPE. Shortage of the PPEs was experienced, followed by the lockdown resulting in sourcing out of medical devices from other countries and expediting the approval process. Each regulatory agency had different methods of strategy to ensure that patients have the essential equipment due to the pandemic (Garzotto et al., 2020). The pandemic and the demand for medical devices skewed the normal balance of supply and demand (Li et al., 2022) thus, maintaining the database provided a comprehensible record relating to the event or incident of medical devices (Hampel, 2022). The data and reports saved in the database could serve as a risk mitigation process when dealing with medical devices in the country.

4.3 Vigilance of the Medical Device Directorate

Identifying gaps in vigilance is an important tool for risk mitigation. The study has identified gaps within the vigilance practice with the MDPC Directorate. The major gap was that the SOP was at the drafting stage when the research was being conducted. The SOP is a detailed document containing protocols for the control and harmonisation of operational steps. By following the evidence-based SOP, uniformity of service and standard is ensured (Rizner and Adamski, 2019). Small and frequent changes were applied to minor parts of the protocol that showed the flexibility of the procedure but, in turn, might also cause process delay. The frequent deviations from the main SOP might lead to unwanted events.[58] The directorate also received all types of reports, including procurement-related reports. In this case, the reporter should assess if the incident was caused by the non-performance of the device, or if the specifications did not match the procedure. Receipt of unfiltered emails might cause delay in addressing events that were potentially serious. At the time of the research, issues pertaining to specifications were forwarded to the proper authorities (for example with the procurement-related reports). Analysing such reports would allow the procurement process to be more detailed and specification-oriented. Email filtration or a separate reporting process can be considered as a way forward. Strengths were also identified from the gap analysis. The directorate was in the process of finalising the SOP and has taken the risk mitigation process into account for the final version of the SOP in efforts to reduce the gap as much as possible. The proactive approach to establish and improve the SOP is one of the foundations of the vigilance system and continuous risk mitigation (Dubromel et al., 2016).

[58] Small A. Human Factors Analysis and Classification System (HFACS): As Applied to Asiana Airlines Flight 214. The Journal of Purdue Undergraduate Research. 2020; 10:18. DOI:10.7771/2158-4052.1485

The directorate has a good relationship with the stakeholders thereby creating a harmonised and direct communication when discussing events pertaining to medical devices. The innovation of the directorate to act as quickly as possible showed their compliance and promotion of safety. Opportunities to improve the vigilance system included establishing a uniformed timeframe which was proposed with the Risk Management Plan (Appendix 2). A triage system to filter emails according to the nature of the event could also benefit the directorate in streamlining their vigilance service and reduce the number of unrelated reports. Promotion and education of incident reporting should also be encouraged as it allows the directorate to be more knowledgeable about the real-life situation of medical devices in the country. The incident reporting system should be well-known to medical device users for the improvement of safety strategies in healthcare. Incident reporting would also help in avoiding widespread major disasters that might threaten the public's safety (Macrae, 2016).

4.4 Risk Management Plan

A robust risk management plan can help promote safety and gain the trust of the public with the vigilance system.[59] Performing a risk management process is important in mitigating and minimising events that would impact health and safety (El Baz and Ruel, 2020). A pilot implementation, through the use of the developed risk management plan, was done by an assessor who is the person-in-charge for receiving medical device incident reports in the directorate. The inclusion of the risk management plan to the standardised assessment of incident reports of the directorate yielded positive results in terms of turnaround time and ease of risk scoring. The use of the risk management plan as a part

[59] Sobanjo-ter Meulen A, Munoz FM, Kaslow DC, Klugman KP, Omer SB, Vora P, et al. Maternal Interventions Vigilance Harmonisation in Low and Middle-Income Countries: Stakeholder Meeting Report; Amsterdam, May 1–2, 2018. Vaccine X. 2019;37:2643–2650. DOI: 10.1016/j.vaccine.2019.03.060

of the directorate's on-going SOP did not substantially cause a delay with the overall review process. The scoring system from the risk matrix provided a better understanding on how to address the incident report at hand and suggest the estimated time to take action depending on the determined risk criteria. From the pilot implementation, six of the incident reports were low risk which recommends initiation of the process and investigation within seven days, and four were moderate risk which recommends initiation of the process and investigation according to the SOP within 48-72 hours (Table 3.4 and Appendix 2). The directorate had surpassed the expectation from the recommendation as they managed to initiate investigations on a shorter time frame which reduced the lag time. This positive performance supports the efforts of the medical device directorate for continuous vigilance and promotion of patient safety. As risk management is a critical part of medical device vigilance, understanding its role in filtering potential risks in using medical devices is necessary (Sharma and Luthra, 2023).

4.5 Limitations of the Study

A limitation of the study is that for the CEF database data collection, only 2021 and 2022 were complete, hence, comparing the rise of CEFs may not reflect the EU-wide status of medical devices. For the risk management plan, the number and variety of incident reports that was reviewed was limited, thus increasing the number of the incident reports might reflect a better picture of the turnaround time for reviewing the reports and the effectiveness of risk scoring of the risk matrix. An updated and enhanced version of the risk management plan may also be developed upon the finalisation of the SOP of the directorate unit.

4.6 Recommendations for Further Research

The study has shown multiple evidence for barriers in reporting which pose a risk to the vigilance of medical devices. Further research should determine barriers in a local setting such as, but not limited to, Mater Dei Hospital, polyclinics and community pharmacies available in the island. In depth understanding about under-reporting may help improve the overall vigilance system in the country. Further development of the CEF database is recommended, increasing the years being analysed to have a better picture of the inquiry system. Increasing the number and diversifying the type of incident reports to assess using the risk management plan are recommended to determine any residual risks and remaining gaps in vigilance of the medical devices. An updated risk management plan should be developed upon the finalisation of the SOP of the directorate to ensure continuity and applicability.

4.7 Conclusion

Medical devices have a vital role in healthcare but in certain cases, use of medical devices can result in unexpected incidents resulting in potential harm, injury or impediment to its users, loss and/or even damage (Polisena et al., 2015).

This study concluded the following:

1. The study identified that under-reporting from the end-users is the primary barrier in vigilance of medical devices. Multiple barriers that could pose risks in the vigilance system of medical devices were identified (Figure 3.1). Factors such as perception of consequence, blame culture, and workload prevents the end-user from reporting an incident. Addressing such barriers would create a more harmonious environment where incident reporting is a positive situation, learning curve, and a source of improvement for

health services. Recommendations such as continuous education and training with medical device reporting, providing feedback to reports, system transparency, providing a climate of openness, and inclusion of pharmacists in history taking of medical device use should be considered (Figure 3.2). Addressing and preventing the root cause of these barriers contributes to the advocacy for quality and promotes safety to all users and stakeholders of medical devices.

2. The development and evaluation of a database for the CEF assists in monitoring investigations with medical devices. The database creates a simple and efficient system that could track inquiry and issues about medical devices across the EU. The evaluation of the CEF showed that there is a difference with the number of initiated CEF (Figure 3.4 and 3.5) from different countries. The difference could be due to the accessibility of the reporting system. For instance, in Germany, end-users can submit incident reports through pharmacies. This creates a reachable avenue for the public when it comes to incident reporting. Estonia has digitalisation protocols where transactions such as reporting is done online. Coordination of the reporting system should also be done as accessibility of incident forms are not the same across different EU states. Among the member states, only 14 countries have an online form for incident reporting by healthcare providers.[60] All member states should consider establishing an obligatory incident reporting system for both general public and healthcare providers to ensure that incidents are accounted for. A harmonised system for assessing the lack of incident reporting should be established.

3. The study identified gaps in the vigilance of the MDPC Directorate. The primary gap for vigilance is that the SOP of the directorate is still in the drafting stage at the time of

[60] Cardona Xuereb P. Regulation of Medical Devices [Dissertation]. Msida: University of Malta; 2020

the research. Proactive approach on the finalisation of the SOP is recommended as it is one of the foundations of the vigilance system (Dubromel et al., 2016). The strengths, flexibility and willingness of the directorate to act upon different gaps, while ensuring that the legislation and regulations are being upheld are reflected in the study (Table 3.2).

4. Incorporating the risk management plan with the current SOP of the directorate is an effective way of mitigating risks of medical devices. During the pilot implementation of the risk management plan, 10 incident reports were assessed. The assessor scored the 10 incident reports without difficulty (Table 3.4) implying that the addition of the risk assessment step does not compromise the turnaround time for the SOP and only strengthens the risk mitigation process. Identifying the risk criteria from Table 3.4 and Appendix 2 provides a clear recommendation on how to reduce the risk identified during the assessment process. The risk management plan also contributes to the importance and seriousness of incident reporting for the safety of end-users.

REFERENCES

AlBlaihed RM, AlSaeed MI, Abuabat AA, Ahsan SH. Incident Reporting in Dentistry: Clinical Supervisor's Awareness, Practice and Perceived Barriers. Eur J Dent Educ. 2017; 22: e408-418. DOI: 10.1111/eje.12319

Aljabari S, Kadhim Z. Common Barriers to Reporting Medical Errors. ScientificWorldJournal. 2021; 2021: e6494889. DOI: 10.1155/2021/6494889

Almadi MA, Alsohaibani FI. Reporting Adverse Medical Device Events Is an Obligation and Not a "Fashion". Obesity Surg. 2019; 29:2974-2975. DOI:10.1007/s11695-019-03974-6

Altenstetter C. EU and Member State Medical Devices Regulation. Int J Technol Assess Health Care. 2003; 19:228-48. DOI: 10.1017/S0266462303000217

Altenstetter C. Medical Devices: European Union Policymaking and the Implementation of Health and Patient Safety in France. 1st ed. New York: Routledge; 2008. P196.

Anderson JE, Kodate N, Walters R, Dodds A. Can Incident Reporting Improve Safety? Healthcare Practitioners' Views of the Effectiveness of Incident Reporting. Int J Qual Health Care. 2013;25: 141–150. DOI: 10.1093/intqhc/mzs081

Antich-Isern P, Caro-Barri J, Aparicio-Blanco J. The Combination of Medical Devices and Medicinal Products Revisited from the New European Legal Framework. Int J Pharm. 2021; 607:120992. DOI: 10.1016/j.ijpharm.2021.1209-92

Arnoldi J. Risks: An Introduction. 1st ed. UK: Polity Press; 2009. P50-55.

Benn J, Koutantji M, Wallace L, Spurgeon P, Rejman M, Healy A, et al. Feedback from Incident Reporting: Information and Action to Improve Patient Safety. Qual Saf Health Care. 2009; 18:11-21. DOI: 10.1136/qshc.2007.024166

Aspers P, Corte U. What is Qualitative in Qualitative Research. Qual Sociol. 2019; 42:139-160. DOI:10.1007/s11133-019-9413-7

Bhardwaj A, Sivapathasundaram N, Yusof M, Minghat A, Swe K, Sinha N. The Prevalence of Accidental Needle Stick Injury and their Reporting among Healthcare Workers in Orthopaedic Wards in General Hospital Melaka, Malaysia. Malays Orthop J. 2014;8(2):6-13. DOI: 10.5704/MOJ.1407.009

Beauchamp G. On How Risk and Group Size Interact to Influence Vigilance. Biol Rev. 2019; 94:1918-1934. DOI: 10.1111/brv.12540

Bernstein PL. Against the Gods: The Remarkable Story of Risk. New York: John Wiley & Sons; 1996. P269

Blankholm AD, Hansson B. Incident Reporting and Level of MR Safety Education: A Danish National Study. Radiology. 2020; 26:147-153. DOI: 10.1016/j.radi.2019.10.007

Briguglio L, editor. Small States and the European Union: Introduction. 1st ed. New York: Routledge; 2016. P1

Cardona Xuereb P. Regulation of Medical Devices [Dissertation]. Msida: University of Malta; 2020

Chakrabarty M, Thawani V. Starting a Pharmacovigilance Center: Actions for Implementation. J Pharmacol Pharmacother. 2011; 4:295-299. DOI: 10.4103/0976-500X.85945

Chen YJ, Chiou CM, Huang YW, Tu PW, Lee YC, Chien CH. A Comparative Study of Medical Device Regulations: US, Europe, Canada, and Taiwan. Ther Innov Regul Sci. 2018; 52:62-69. DOI: 10.1177/2168479017716712

Choi SJ, Nam KC, Choi S, Kim JK, Lee Yk, Kwon BS. The Establishment of the Korean Medical Device Safety Information Monitoring Center: Reviewing Ten Years of Experience. Health Pol. 2021; 125: 941–946. DOI: 10.1016/j.healthpol.2021.04.017.

Cooper J, Edwards A, Williams H, Sheikh A, Parry G, Hibbert P, et al. Nature of Blame in Patient Safety Incident Reports: Mixed Methods Analysis of a National Database. Ann Fam Med. 2017; 15:455-461. DOI:10.1370/afm.2123

Craig A, O'Meley P, Carter P. The Need for Greater Reporting of Medical Device Incidents. EMJ Innov. 2019; 3:56-63. DOI: 10.33590/emjinnov/10312553

Crunden EA, Worsley PR, Coleman SB, Schoonhoven L. Barriers and Facilitators to Reporting Medical Device-related Pressure Ulcers: A Qualitative Exploration of International Practice. Int J Nurs Stud. 2022; 135:104326. DOI: 10.1016/j.ijnurstu.2022.104326

Dall'Aglio M, Bellavia G, Allegretti C, Luoni A, Venturelli GP. Vigilance System for Medical Devices: The Experience of an Italian Hospital. Eur J Hosp Pharm. 2012; 19:202. DOI: 10.1136/ejhpharm-2012-000074.308

Danielis M, Bellomo F, Farneti F, Palese A. Critical Incidents Rates and Types in Italian Intensive Care Units: A Five-year Analysis. Intensive Crit Care Nurs. 2021; 62: 102950-102950. DOI: 10.1016/j.iccn.2020.102950

Deipolyi AR, Prabhakar AM, Naidu S, Oklu R. Needlestick Injuries in Interventional Radiology Are Common and Underreported. Radiology. 2017; 285: 870–875. DOI: 10.1148/radiol.2017170103

Denny E, Weckesser A. How to do Qualitative Research?. BJOG. 2022;129: 1166– 1167. DOI: 10.1111/1471-0528.17150

Dong Y, Li F, Li J, Li R, Wang Q. Multicenter Cross-sectional Study on the Reporting Status and Influencing Factors of Needlestick Injuries Caused by Insulin Injection Devices Among Nurses in Peking, China. Am J Infect Control. 2020; 48:805-809. DOI: 10.1016/j.ajic.2019.10.021

Dubromel A, Charra F, Bourge X, Philibert M, Locher F, Derain L. PS-046 Materiovigilance Ex Ante Risk Management. Eur J Hosp Pharm. 2016; 23: 234. DOI: 10.1136/ejhpharm-2016-000875.530

Eadie A. Medical Error Reporting Should it be Mandatory in Scotland?. J Forensic Leg Med. 2012;19: 437–441. DOI: 10.1016/j.jflm.2012.04.007

El Baz J, Ruel S. Can Supply Chain Risk Management Practices Mitigate the Disruption Impacts on Supply Chains' Resilience and Robustness? Evidence from an Empirical Survey in a COVID-19 Outbreak Era. Int J Prod Econ. 2021; 233: e107972.

Elbeddini A, Yeats A, Lee S. Amid COVID-19: The Importance of Developing a Positive Adverse Drug Reaction (ADR) and Medical Device Incident (MDI) Reporting Culture for Global Health and Public Safety. J Pharm Policy Pract. 2020; 13:1-4. DOI: 10.1186/s40545-020-00219-1

Evans S, Berry J, Smith B, Esterman A, Selim P, O'Shaughnessy J, et al. Attitudes and Barriers to Incident Reporting: A Collaborative Hospital Study. Qual Saf Health Care. 2006; 5:39-43. DOI: 10.1136/qshc.2004.012559

Eyvindson K and Kangas AS. Guidelines for Risk Management in Forest Planning - What is Risk and When is Risk Management Useful?. Can J For Res. 2018; 48:309-316. DOI: 10.1139/cjfr-2017-0251

Fraser AG, Byrne RA, Kautzner J, Butchart EG, Szymański P, Leggeri I, et al. Implementing the New European Regulations on Medical Devices—Clinical Responsibilities for Evidence-based Practice: A Report. Eur Heart J. 2020; 41:2589–2596. DOI: 10.1093/eurheartj/ehaa382

Frontini R. Falsified Medicines Directive: Are We Heading in the Right Direction?. J Med Access. 2017;1-1. DOI: 10.5301/maapoc.0000011

Fujita S, Seto K, Hatakeyama Y, Onishi R, Matsumoto K, Nagai Y, et al. Patient Safety Management Systems and Activities Related to Promoting Voluntary In-hospital Reporting and Mandatory National-level Reporting for Patient Safety Issues: A Cross-sectional Study. PLoS One. 2021. 07;16-17. DOI: 10.1371/journal.pone.0255329

Fukami T, Uemura M, Nagao Y. Significance of Incident Reports by Medical Doctors for Organisational Transparency and Driving Forces for Patient Safety. Patient Saf Surg. 2020; 14:1-7. DOI: 10.1186/s13037-020-00240-y

Gandhi TK, Graydon-Baker E, Neppl Huber C, Whittemore AD, Gustafson M. Closing the Loop: Follow-up and Feedback in a Patient Safety Program. Jt Comm J Qual Patient Saf. 2005; 31:614-621. DOI: 10.1016/s1553-7250(05)31079-8

Garrett T, Reeves D, Went D. Engaging Pharmacists in Adverse Medication Incident Reporting: Pilot of a Streamlined Reporting Application. J Res Pharm Pract. 2010;40: 269-274. DOI: 10.1002/j.2055-2335. 2010.tb00558.

Garzotto F, Ceresola E, Panagiotakopoulou S, Spina G, Menotto F, Benozzi M, et al. COVID-19: Ensuring our Medical Equipment Can Meet the Challenge. Expert Rev Med Devices. 2020;17(6):483-489

Grier RA, Warm JS, Dember WN, et al. The Vigilance Decrement Reflects Limitations in Effortful Attention, Not Mindlessness. J Cogn Eng Decis Mak. 2003;45(3):349–359. DOI: 10.1518/hfes.45.3.349.27253

Goble R, Bier V, Renn O. Two Types of Vigilance Are Essential to Effective Hazard Management: Maintaining Both Together is Difficult. Risk Anal. 2018; 38: 1795-1801. DOI: 10.1111/risa.13003

Hacking I. The Emergence of Probability: A Philosophical Study of Early Ideas About Probability, Induction and Statistical inference. Cambridge: Cambridge University Press; 2006. P95

Hampel, G. Creating the Conceptual and Logical Model of a Journal Database. Anal Tech Szeged. 2022; 16:110–121. DOI: 10.14232/analecta.2022.1.110-121

Han JED, Ibrahim H, Aiyegbusi OL, Liu X, Marston E, Denniston AK, et al. Opportunities and Risks of UK Medical Device Reform. Ther Innov Regul Sci. 2022. 56, 596–606. DOI: 10.1007/s43441-022-00394-0

Hazell L, Shakir SA. Under-reporting of Adverse Drug Reactions: A Systematic Review. Drug Saf. 2006;29(5):385-96. DOI: 10.2165/00002018-200629050-00003.

Heissing R, van Troostenburg AR. General Principles of Pharmacovigilance in Clinical Development. Curr Med. 2020; 2:1071–1081 DOI: 10.1007/978-3-319-68864-0_63

Helms MM, Nixon J. Exploring SWOT Analysis-Where Are We Now? A Review of Academic Research from the Last Decade. J Econ Manag Strat. 2010; 3:215-251. DOI:10.1108/17554251011064837

Howell A, Burns EM, Hull L, Mayer E, Sevdalis N, Darzi A. International recommendations for national patient safety incident reporting systems: an expert Delphi consensus-building process. BMJ Quality & Safety. 2017; 26:150. DOI: 10.1136/bmjqs-2015-004456

Hussain R, Akram T, Hassali MA, Muneswarao J, ur Rehman A, Hasmi F, et al. Barriers and Facilitators to Pharmacovigilance Activities in Pakistan: A Healthcare Professionals-based Survey. PLoS One. 2022. 9;17(7): e0271587. DOI: 10.1371/journal.pone.0271587.

Hutchinson A, Young TA, Cooper KL, McIntosh A, Karnon JD, Scobie S, et al. Trends in Healthcare Incident Reporting and Relationship to Safety and Quality Data in Acute Hospitals: Results from the National Reporting and Learning System. Qual Saf Health Care. 2009; 18:5-10. DOI: 10.1136/qshc.2007.022400

Imbs JL, Welsch M. Pharmacovigilance [Drug vigilance]. Rev Prat. 2002;52(5):502-506. DOI: 10.1016/S0001-4079(19)33885-3

Jahangiri M, Rostamabadi A, Hoboubi N, Tadayon N, Soleimani A. Needle Stick Injuries and their Related Safety Measures among Nurses in a University Hospital, Shiraz, Iran. Safety and Health at Work. 2016; 7:72-77 DOI: 10.1016/j.shaw.2015.07.006

Jang HJ, Choi YD, Kim NH. Effects and Satisfaction of Medical Device Safety Information Reporting System Using Electronic Medical Record. Healthc Inform Res. 2017; 23:94-100. DOI:10.4258/hir.2017.23.2.94

Januskiene J, Segec A, Slattery J, Genov G, Plueschke K, Kurz X, et al. What are the Patients' and Healthcare Professionals' Understanding and Behaviors Towards Adverse Drug Reaction Reporting and Additional Monitoring?. Pharmacoepidemiol Drug Saf. 2021; 30(3):334–41. DOI: 10.1002/pds.5162

Janusziewicz AN, Glueck SN, Park SY, Nguyen DN, Rimmel SC, Cascio LA, et al. A Pharmacist-driven Food and Drug Administration Incident Surveillance and Response Program for Compounded Drugs. Am J Health-Syst Pharm. 2021; 78:1438-443. DOI:10.1093/ajhp/zxab176

Jarman H, Rozenblum S, Huang TJ. Neither Protective nor Harmonised: The Cross Border Regulation of Medical Devices in the EU. Health Econ Policy Law. 2021;16(1):51-63. DOI: 10.1017/S1744133120000158

Johan K, Boel H, Hall A, Anders T, Lundberg P. Magnetic Resonance Imaging Incidents are Severely Underreported: A Finding in a Multicentre Interview Survey. Eur Radiol. 2022; 32:477-488. DOI: 0.1007/s00330-021-08160-w

Kramer DB, Tan YT, Sato C, Kesselheim AS. Ensuring Medical Device Effectiveness and Safety: A Cross-national Comparison of Approaches to Regulation. Food Drug Law J. 2014; 69:1-23

Lahiry S, Sinha R, Chatterjee S. Medical Device Regulation in India: What Dermatologists Need to Know. Indian J Dermatol Venereol Leprol. 2019; 85:133-137. DOI: 10.4103/ijdvl.IJDVL_326_18

Lanza ML, Zeiss RA, Rierdan J. Multiple Perspectives on Assault: The 360-degree Interview. J Am Psychiatr Nurses Assoc. 2009;14: 413-420. DOI: 10.1177/1078390308327039

Lazarou J, Pomeranz BH, Corey PN. Incidence of Adverse Drug Reactions in Hospitalised Patients - A Meta-Analysis of Prospective Studies. JAMA. 1998; 279:1200-5. DOI: 10.1001/jama.279.15.1200

Lennard N, Coutinho M, Campbell B. The Surgeon and Medical Devices: Adverse Incident Reporting and Off-label Use. Ann R Coll Surg Engl. 2013. 95(5):309-10. DOI: 10.1308/003588413X13629960046165

Leone R, Moretti U, D'Incau P, Conforti A, Magro L, Lora R, et al. Effect of Pharmacist Involvement on Patient Reporting of Adverse Drug Reactions: First Italian Study. Drug Saf. 2013; 36:267-276. DOI: 10.1007/s40264-013-0028-8

Li Z, Sheng Y, Meng Q, Hu X. Sustainable Supply Chain Operation Under COVID-19: Influences and Response Strategies. Int J Logist Res Appl. 2022; 25: 1-27. DOI: 10.1080/13675567.2022.2110220

Macrae C. The Problem with Incident Reporting. BMJ Qual Saf. 2016; 25:71-75.

Marini P, Bazzani D, Guido E, Gandini A, Maffei E, Laciotti M, et al. The AOUI Verona Task Force for Improvement of Post-Market Clinical Surveillance for Medical Device. Drug Saf. 2022; 45: 1266–1267.

Mohamed MFH, Abubeker IY, Al-Mohanadi D, Al-Mohammed A, Abou-Samra AB, Elzouki AN. Perceived Barriers of Incident Reporting Among Internists: Results from

Hamad Medical Corporation in Qatar. Avicenna J Med. 2021; 11:139-144. DOI:10.1055/s-0041-1734386

Murphy BM, Frigo LC. Development, Implementation, and Results of a Successful Multidisciplinary Adverse Drug Reaction Reporting Program in a University Teaching Hospital. Hosp Pharm. 1993; 28:1199-204,240.

Nandra RS, Ahmed U, Berryman F, Brash L, Dunlop DJ, Matharu GS. How much does a Medical and Healthcare Products Regulatory Agency Medical Device Alert for Metal-on-metal Hip Arthroplasty Patients Really Cost?. HIP International. 2022. 32(4):493-500. DOI: 10.1177/1120700020983297

Neerhof AR. The Use of Conformity Assessment of Construction Products by the European Union and National Governments: Legitimacy, Effectiveness and the Functioning of the Union Market. In: Rott P, editor. Certification – Trust, Accountability, Liability. Cham, Switzerland: Springer; 2019. P.73–106. DOI: 10.1007/978-3-030-02499-4_4

Odone A, Buttigieg S, Ricciardi W, Azzopardi-Muscat N, Staines A. Public Health Digitalisation in Europe: EUPHA Vision, Action and Role in Digital Public Health. Eur J Public Health. 2019; 29: 28-35

Palojoki S, Saranto K, Lehtonen L. Reporting Medical Device Safety Incidents to Regulatory Authorities: An Analysis and Classification of Technology-Induced Errors. Health Informatics J. 2019; 25:731-740. DOI:10.1177/1460458217720400

Pane J, Coloma PM, Verhamme KMC, Sturkenboom MCJM, Rebollo I. Evaluating the Safety Profile of Non-Active Implantable Medical Devices Compared with Medicines. Drug Saf. 2017;40(1):37-47. DOI: 10.1007/s40264-016-0474-1

Pane J, Francisca RDC, Verhamme KMC, Orozco M, Viroux H, Rebollo I, et al. EU Postmarket Surveillance Plans for Medical Devices. Pharmacoepidemiol Drug Saf. 2019; 28: 1155– 1165. DOI: 10.1002/pds.4859

Panchal YN, Vyas BM, Suthar KM, Shah KN. A Study of Assessing Knowledge, Attitude, and Practice of Materiovigilance Among Medical Surgeons of Gujarat. Natl J Physiol Pharm Pharmacol. 2022; 12:1792-1797. DOI: 10.5455/njppp.2022.12.03103202207032022

Polisena J, Gagliardi A, Urbach D, Clifford T, Fiander M. Factors that Influence the Recognition, Reporting and Resolution of Incidents Related to Medical Devices and other Healthcare Technologies: A Systematic Review. Syst Rev. 2015; 4:15-28. DOI: 10.1186/s13643-015-0028-0

Qouhafa M, Benaji B, Lebbar S, Soulaymani A, Moukhtari A. Development and Implementation of a System for Medical Devices Monitoring in Morocco. E3S Web Conf. 2021; 319:1086. DOI: 10.1051/e3sconf/202131901086

Rahimi R, Omar E, Soh TST, Nawi SFAM, Noor SMD. A Sudden Paediatric Death Due to Hand, Foot and Mouth Disease: The Importance of Vigilance. Malays J Pathol. 2017; 39:167-170. DOI: 10.1016/j. Ijid.2016.02.725

Ranjbari M, Shams Esfandabadi Z, Gautam S, Ferraris A, Scagnelli SD. Waste Management Beyond the COVID-19 Pandemic: Bibliometric and Text Mining Analyses. Gondwana Res. 2022; 102: 1-14. DOI:10.1016/j.gr.2021.12.015

Rasborg, K. What Is Risk?. In: Ulrich Beck. Theorising World Risk Society and Cosmopolitanism. London: Palgrave Macmillan; 2021. p 13-25.

Reed S, Arnal D, Frank O, Gomez-Arnau JI, Hansen J, Lester O, et al. National Critical Incident Reporting Systems Relevant to Anaesthesia: A European Survey. Br J Anaesth. 2014; 112(3):546-55. DOI: 10.1093/bja/aet406

Rizner TL, Adamski J. Paramount Importance of Sample Quality in Pre-Clinical and Clinical Research—Need for Standard Operating Procedures (SOPs). J Steroid Biochem Mol Biol. 2019; 186:1-3. DOI: 10.1016/j.jsbmb.2018.09.017

Sarkissian A. An Exploratory Analysis of the U.S. FDA Class I Medical Device Recalls: 2014–2018. J Med Eng Technol. 2018; 42:8: 595-603. DOI: 10.1080/03091902.2019.1580778

Siekmeier R, Lütz J. Experience with post-market surveillance of in-vitro diagnostic medical devices for lay use in Germany. Clin Chem Lab Med. 2007; 45:396–401. DOI: 10.1515/CCLM.2007.058

Sharma, A. and Luthra, G. A Comprehensive Review of Risk Management in the Medical Device Industry. J Pharm Res Int. 2023; 35:14–23. DOI: 10.9734/jpri/2023/v35i67330

Shukla S, Gupta M, Pandit S, Thomson M, Shivhare A, Kalaiselvan V, et al. Implementation of Adverse Event Reporting for Medical Devices, India. Bull WHO. 2020; 98:206-211. DOI: 10.2471/BLT.19.232785

Sienkiewicz K, Burzyńska M, Rydlewska-Liszkowska I, Sienkiewicz J, Gaszyńska E. The Importance of Direct Patient Reporting of Adverse Drug Reactions in the Safety Monitoring Process. Int J Environ Res Public Health. 2021; 19:413. DOI:10.3390/ijerph19010413

Singh J, Singh H, Rohilla R, Kumar R, Gautam CS. Lack of Awareness of Pharmacovigilance among Young Health-care Professionals in India: An Issue Requiring Urgent Intervention. Int J Appl Basic Med Res. 2018; 8:158-163. DOI:10.4103/ijabmr.IJABMR_423_17

Small ML. What is Qualitative in Qualitative Research? Why the Answer does not Matter but the Question is Important. Qual Sociol. 2021; 44: 567-574. DOI:10.1007/s11133-021-09501-3

Swayze S, Rich S. Promoting Safe Use of Medical Devices. Online J Issues Nurs. 2011;17(1). DOI: 10.3912/OJIN.Vol17No01PPT01

Tase A, Ni MZ, Buckle PW, Hanna GB. Current Status of Medical Device Malfunction Reporting: Using End User Experience to Identify Current Problems. BMJ Open Qual. 2022; 11: e001849. DOI:10.1136/bmjoq-2022-001849

Tau N, Shepshelovich D. Assessment of Data Sources That Support US Food and Drug Administration Medical Devices Safety Communications. JAMA Intern Med. 2020; 180(11):1420–1426. DOI: 10.1001/jamainternmed.2020.3514

Toklu HZ, Mensah E. Why do we Need Pharmacists in Pharmacovigilance Systems?. Online J Public Health Inform. 2016; 8: e193. DOI:10.5210/ojphi.v8i2.6802

Torrente D, Gallo P, Oltra C. Comparing Crime Reporting Factors in EU Countries. Eur J Crim Policy Res. 2017; 23:153–174. DOI:10.1007/s10610-016-9310-5

Turner, Christopher. Use of Mobile Devices in Community Health Care: Barriers and Solutions to Implementation. Br J Community Nurs. 2016; 21:100–102. DOI: 10.12968/bjcn.2016.21.2.100

Vărzaru AA. An Empirical Framework for Assessment of the Effects of Digital Technologies on Sustainability Accounting and Reporting in the European Union. Electronics. 2022; 11:3812. DOI: 10.3390/electronics11223812

von Mallek, D. Importance of the Medical Device Vigilance System for the Clinician. Legal Medicine. 2015;25: 427–437. DOI: 10.1007/s00194-015-0007-8

Wang X, Yang L, Zhao Y, Yu Z, Li Z. The Group Size Effect and Synchronisation of Vigilance in the Tibetan Wild Ass. Curr Zool . 2021; 67:11-16. DOI: 10.1093/cz/zoaa024

Yoon C, Nam KC, Lee YK, Kang Y, Choi SJ, Shin HM, et al. Differences in Perspectives of Medical Device Adverse Events: Observational Results in Training Program Using Virtual Cases. J Korean Med Sci. 2019; 34-39:e255. DOI: 10.3346/jkms.2019.34.e255

Yu T, Zhang X, Wang Q, Zheng F, Wang L. Communication Openness and Nosocomial Infection Reporting: The Mediating Role of Team Cohesion. BMC Health Serv Res. 2022; 22: 1416. DOI:10.1186/s12913-022-08646-3

Appendix 1

ETHICS APPROVAL

The status of your REDP form (MED-2022-00082) has been updated to Acknowledged

Inbox ×

form.urec@um.edu.mt Tue, 3 May 2022, 11:27

to me

Dear Danielle Claire Almojero,

Please note that the status of your REDP form (MED-2022-00082) has been set to *Acknowledged*.

You can keep track of your applications by visiting: https://www.um.edu.mt/research/ethics/redp-form/frontEnd/.

This email has been automatically generated by URECA. Please do not reply. If you wish to communicate with your F/REC please use the respective email address.

Draft/Submitted REDP Forms

Show 10 entries Search:

Application ID	Application Date	Project Title	Faculty	Status
MED-2022-00082	09/04/2022	Risks in Medical Device Vigilance	Faculty of Medicine & Surgery	Acknowledged

Showing 1 to 1 of 1 entries Previous 1 Next

Submit New REDP Form

Applicant Signature: * Danielle Claire E. Almojero

Date of Submission: * 09/04/2022

If applicable: Date collection start date

Administration

REDP Application ID MED-2022-00082

Current Status Acknowledged

Appendix 2

RISK MANAGEMENT PLAN

Risk Management Plan for Medical Device Incident Reports

Aim of the Risk Management Plan

The aim of the document is to assess the risk of each medical device incident report received by the Directorate. The reports received are to be scored using the matrix contained in the document. Risk is defined as the 'combination of the probability of occurrence of harm and the severity of that harm' [1] and the 'impact of uncertainty on decision -making' [2]. Successful risk management includes the systemic application of identifying the future consequences of a current or proposed action. [3]

Application of the Risk Management Plan

The importance of the document is to contribute to the continuous efforts of ensuring patient safety and further improvement of medical device vigilance. The application of the document pursues the enhancement of turnaround time in handling medical device incident reports, refinement of definitions of risks and criteria of risks, and mitigation of risks associated with incident reports of medical devices received by the Directorate.

Definitions

Impact: describes all the changes which are expected to happen due to implementation and application of a given policy/interventions [4]

Probability: related to frequency of occurrences or degree of belief in the likely occurrence of an event [5], or the probability of occurrence of harm [6]

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[1] International Organization for Standardization. ISO 14971:2019. Medical Devices - Application of risk management to medical devices. Geneva: ISO; 2019

[2] Hansson S. The Ethics of Risk: Ethical Analysis in an Uncertain World. New York: Palgrave Macmillan; 2013. P80-93

[3] Birley M. Health Impact Assessment:Principles and Practice. London: Taylor & Francis Group; 2011. P2

[4] European Commission (EC) [Internet]. Impact Assessment in the Commission; 2003 [cited 2023 Feb 04]. Available from: https://ec.europa.eu/governance/docs/comm_impact_en.pdf

[5] International Organization for Standardization. ISO 3534-1:2006. Vocabulary and symbols - Part1 General statistical terms and terms used in probability. Geneva: ISO; 2006

[6] International Organization for Standardization. ISO/IEC Guide 51:2014. Safety aspects — Guidelines for their inclusion in standards. Geneva: ISO; 2014

Instructions for the Risk Management Plan

Steps:

1. Score the incident report received by the Directorate based on the Risk Assessment Matrix (Table 1) after review and classification of the incident report according to the Standard Operating Procedure (SOP) of the Directorate.
    a. Use Impact Assessment Table 1.1 to score the incident report based on the effect of the incident to the overall safety of end-users. 1 as insignificant and 5 as severe.
    b. Use Probability Assessment Table 2.2 to score incident report based on the frequency of occurrence of the incident and the probability of causing harm to the end-users. 1 as improbable and 5 as frequent.
    c. The Risk Priority Number (RPN) or risk score is provided in the box where the probability column and impact intersect. RPN is the product of multiplying probability rating with impact rating (P x I).
2. Use Risk Criteria Table 2 to indicate the criteria of risk from the risk priority number of the risk assessment matrix.
3. Use Table 3 to determine the recommendation for the identified risk criteria of the incident report, and the post-assessment recommendations per risk criteria.
   Table 3 contains:
    a. The timeframe recommendation for initiation of procedure or investigation of the incident report according to each risk criteria.
    b. The review and post-assessment recommendations for other incident reports with similar risk criteria. This can be used to identify other risk factors of the incident report.

Table 1 Risk assessment matrix

	IMPACT OF THE INCIDENT REPORT				
PROBABILITY	Insignificant (1)	Minor (2)	Moderate (3)	Major (4)	Extreme (5)
Frequent (5)	5	10	15	20	25
Probable (4)	4	8	12	16	20
Occasional (3)	3	6	9	12	15
Remote (2)	2	4	6	8	10
Improbable (1)	1	2	3	4	5

Table 1.1 Impact Assessment

Impact of incident report	Definitions [7,8,9]
Insignificant (1)	Minimal or no adverse impact on person's health; unlikely to result in adverse regulatory response or action
Minor (2)	Results in temporary injury or impairment not requiring medical or surgical intervention; event with consequences that can be readily absorbed but requires management effort to minimise the impact; potential adverse impact on person's health / welfare

[7] European Commission (EC) [Internet]. EU general risk assessment methodology; 2015 [cited 2023 Feb 05]. Available from: https://ec.europa.eu/docsroom/documents/17107/attachments/1/translations/en/renditions/pdf

[8] International Organization for Standardization. ISO/TR 24971:2020. Medical devices - Guidance on the application of ISO 14971. Geneva: ISO; 2020

[9] Pascarella G, Rossi M, Montella E, Capasso A, De Feo G, Botti G, et al. Risk Analysis in Healthcare Organizations: Methodological Framework and Critical Variables. Risk Manag Healthc Policy. 2021;14:2897-2911. DOI: 10.2147/RMHP

Moderate (3)	Adverse impact on person's health / welfare; significant stress and a noticeable reduction on ability to perform regular duties in the immediate future; significant event or circumstance that can be managed under normal circumstances
Major (4)	Major or multiple injuries resulting in temporary disability or ill health to one or more persons; serious injury / harm, critical event or circumstance that can be endured with proper management
Extreme (5)	Death or permanent disability; event or circumstance with potentially disastrous impact on business or significant material adverse impact on a key area; severe injury or illness, resulting in permanent injury / disability or ill health to one or more persons; extreme stress and an inability to perform work duties in the foreseeable future

Table 1.2 Probability Assessment

Probability of causing harm	Definitions [10,11]	Semi-quantitative probability range (adapted from ISO/TR 24971:2020) [12]
Improbable (1)	Very unlikely to cause harm; occurrence may not be experienced; event is conceivable, but very unlikely to occur.	$\geq 10^{-6}$ (< 1 event per one million uses)

[10] Amuzu J, Jallow B, Kabo-Bah A, Yaffa S. The Climate Change Vulnerability and Risk Management Matrix for the Coastal Zone of The Gambia. Hydrology. 2018;5:14. DOI: 10.3390/hydrology5010014

[11] Pascarella G, Rossi M, Montella E, Capasso A, De Feo G, Botti G, et al. Risk Analysis in Healthcare Organizations: Methodological Framework and Critical Variables. Risk Manag Healthc Policy. 2021;14:2897-2911. DOI: 10.2147/RMHP

[12] International Organization for Standardization. ISO/TR 24971:2020. Medical devices - Guidance on the application of ISO 14971. Geneva: ISO; 2020

Remote (2)	Event is unlikely to cause harm but is a possibility	$<10^{-3}$ and $\geq 10^{-4}$ (1 event per 999,999 to 1 in a million uses)
Occasional (3)	Event may cause harm occasionally; may cause harm with increased frequency of use; harm might occur at some time (i.e. once in a while)	$<10^{-4}$ and $\geq 10^{-5}$ (1 event per 9,999 to 1 per 100,000 uses)
Probable (4)	Event probably will cause harm in most circumstances (e.g. weekly to monthly); expected to cause harm often	$<10^{-3}$ and $\geq 10^{-4}$ (1 event per 999 to 1 per 10,000 uses)
Frequent (5)	Event is expected to cause harm in most circumstances; occurrence of event will mostly cause harm	$\geq 10^{-3}$ (≥ 1 event per 1,000 uses)

Table 2 Risk Criteria

Risk score	Risk criteria	Description [13,14]
20-25	Extreme risk	Risks that significantly exceed the acceptable tolerance and need urgent and immediate attention.
10-16	High risk	Risks that exceed the risk acceptance threshold and require proactive management.

[13] Australian National University (ANU) [Internet]. Risk Assessment Matrix; 2017 [cited 2023 Feb 02]. Available from: https://services.anu.edu.au/files/document-collection/ANU_Risk_Assessment_Matrix.pdf

[14] Yousefian S, Abbasabadi-Arab M, Saberian P, Kolivand P, Mobini A, Amin SM, et al. Risk Assessment of Arbaeen Mass Gathering in the Covid-19 Pandemic. Dialogues Health 2022;1: DOI: 10.1016/j.dialog.2022.100061

5-9	Moderate risk	Risks that are within the acceptable threshold and require active monitoring.
1-4	Low risk	Risks that are below the acceptable threshold and do not require active management.

Table 3 Recommended response and review

Risk critera	Recommendation *Initiate procedure/investigation according to SOP*	Review and Post-assessment Recommendation
Extreme risk	within 24 hours	Review of medical device specifications and documents Document final decision from investigation Close monitoring if medical device is still present in the market Close monitoring of replacement devices Follow up patients affected, if applicable Perform prevented withdrawal, if needed
High risk		
Moderate risk	within 48-72 hours	Document final decision from investigation Perform further investigation, if needed Perform preventive withdrawal, if applicable
Low risk	within 7 days	Information drive Educating end-users of reporting Suggest re-training for end-users

Annex 1 Review of incident report form

Review incident report form received according to SOP

Sections from the Medical Devices Incident Report Form should be filled out accordingly:[15]

I. Report from General Public (Guidance on IR - General Public):

Section A: Details of Reporter

Section B: Details about Medical Device

Section C: Incident Details

Data Protection Consent Statement

Malta Medicines Authority Declaration for Form Submission

II. Report from Healthcare professional (Guidance on IR - Healthcare Professionals):

Section A: Incident Details

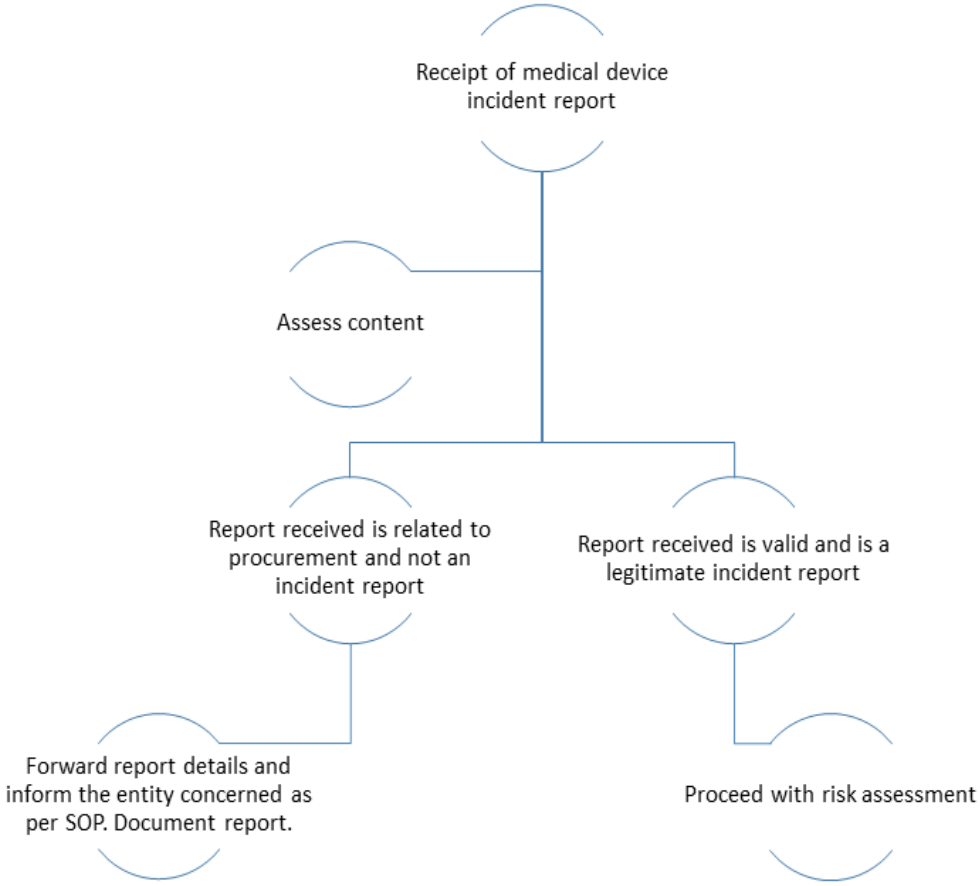
Section B: Reporter's Details

Data Protection Consent Statement

Malta Medicines Authority Declaration for Form Submission

[15] Malta Medicines Authority (MMA) [Internet]. Medical Devices; 2023 [cited 2022 Nov 27]. Available from: https://medicinesauthority.gov.mt/medicaldevices

Annex 2 Classification of incident report form



References

Amuzu J, Jallow B, Kabo-Bah A, Yaffa S. The Climate Change Vulnerability and Risk Management Matrix for the Coastal Zone of The Gambia. Hydrology. 2018;5:14. DOI: 10.3390/hydrology5010014

Birley M. Health Impact Assessment:Principles and Practice. London: Taylor & Francis Group; 2011. P2-3

Hansson S. The Ethics of Risk: Ethical Analysis in an Uncertain World. New York: Palgrave Macmillan; 2013. P80-93

Pascarella G, Rossi M, Montella E, Capasso A, De Feo G, Botti G, et al. Risk Analysis in Healthcare Organizations: Methodological Framework and Critical Variables. Risk Manag Healthc Policy. 2021;14:2897-2911. DOI: 10.2147/RMHP

Yousefian S, Abbasabadi-Arab M, Saberian P, Kolivand P, Mobini A, Amin SM, et al. Risk Assessment of Arbaeen Mass Gathering in the Covid-19 Pandemic. Dialogues Health 2022;1: DOI: 10.1016/j.dialog.2022.100061

Appendix 3

FOCUS GROUP DISCUSSION GUIDELINE

Focus Group Discussion Guideline

Part 1 – Incident Reporting, SOP and Gaps

1. What is the basis for the formulation of the SOP for incident reports?
    a. Such as ISO, medical device regulation, legislation
2. Do you think there are gaps between the current SOP and international standards (ISO, MDR)?
    a. Other potential gaps: implementation, roles of employee, specificity of areas etc
3. Are there any areas of the incident reporting process and medical devices vigilance that needs improvement?

Part 2 – Risks in Medical Device Vigilance

1. Can you provide examples of workplace scenarios that could be considered as risk?
2. What are the preventive measures for risk identification and risk mitigation?
3. How are the risks identified being handled and mitigated?
4. What happens when risks are ignored?

Part 3 – Withdraws and Recalls

1. What triggers a medical device withdrawal or recall from the market?
2. How is the withdrawal and/or recall initiated?
3. What is the role of the directorate for the withdrawal and/recall process?

Part 4 – Decision Making in Vigilance

1. In your role with the directorate, how do you participate in the decision making process?
2. Is there a risk in the decision making process? Provide examples.
3. What are the approaches being done to avoid the risks identified risks?

Appendix 4

FIP DISSEMINATION

FIP Dissemination

Risks in Medical Device Vigilance

Danielle Claire E. Almojero
Dr Maresca Attard-Pizzutto
Prof Anthony Serracino-Inglot

Abstract

Background

Medical devices are products that vary from simple bandages to artificial bones, and intensive security measures are adopted from the approval up to the release of the device to the market for the safety of its users. Medical Device Compliance Exchange Form (CEF) is a communication tool used for data exchange about medical devices between Competent Authorities (CA) and Designating Authorities (DA), in specific cases including Notified Bodies (NB), within the European Union (EU). In Malta, the Medicines Authority (MMA) is the Competent Authority for ensuring medical devices' safety, incident reports and investigation.

Purpose

The purpose of the study is to 1) evaluate the medical devices Compliance Exchange Form (CEF) received by the Authority from other EU member states, including countries under the European Free Trade Association (EFTA) and EU candidate countries, which contains dissemination of information and/or inquiry about medical devices' functions, approval and legal standing ; 2) assess the procedures used by the Authority in handling incident reports for medical devices; and 3) develop a risk management plan for mitigation of risks.

Method

The qualitative study is divided into four phases. Phase 1 is the evaluation and development of the database for the Compliance Exchange Form received by the authority. Phase 2 is the gap analysis of the current Standard Operating Procedures (SOP) of the authority through focus group discussion with three members of the Medical

Devices and Pharmaceutical Collaboration Directorate. Phase 3 is the development of a risk management plan from the gap analysis and focus group discussion, and Phase 4 is the evaluation and dissemination of the risk management plan.

Results

For Phase 1, a database to store all of the received Compliance Exchange Form (CEF) was developed with the MMA OneDrive. From 2021 to 2022, 428 CEFs were saved and evaluated. A total of 9 CEFs involved Malta; 4 of which were addressed to Malta, 3 were sent by the Authority to all European Economic Area (EEA) states, specifically for the Netherlands and Germany, and 2 of the 9 CEFs were enquiries about medical devices that are available in Malta. In Phase 2, the focus group discussion identified 4 main points: i) the present SOP is adequate for operations in Malta, ii) direct communication with stakeholders improves quality of investigation, iii) a gap in the triage system in regards to receiving incident reports is to be improved, and (iv) information dissemination plan to resolve under-reporting of medical device incidents are one of the safety-related projects of the Authority. In Phase 3, a risk management plan utilising a scoring system was developed from the discussion to contribute to the on-going SOP development and continuous vigilance.

Conclusion

The incorporation of the risk management plan with the current practices of the Authority solidifies the goal of safety and reduces the risks in vigilance as it proposes visual steps on handling reports. Further improvement with the risk identification and reporting system awareness can contribute to the continuous improvement of medical device vigilance.

The abstract has been submitted and accepted to the FIP 2023 congress in Brisbane, Australia as a poster presentation.