Good data management and governance: Data integrity

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Abstract — Now-a-days data integrity plays a vital role in the pharmaceutical industry. Even though industries aware of the importance of data integrity most of the companies are failed during the implementation of data integrity. The following review clearly mentioned about the good data management IJSERstates that how to overcome by some of the general considerations and expectations under each components. Clearly mentioned about ALCOA principles.

Key words: ALCOA, computerized systems, data life cycle, data integrity, documents, good management, system designs.

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Introduction

Data integrity (DI) is the degree to which data are complete, consistent, accurate, trustworthy reliable and that features of the data are continued throughout the data life cycle. The data must be collected and conserved in a protected manner so that they are attributable, legible, contemporaneously record, original and risk management system, including adhere to sound scientific principles and good documentation practices.(GDP)[1] Documentation may possibly occur in a diversity of forms, together with paper-based, electronic, photographic media or video recording. Irrespective of the form in which data is kept, suitable controls should be implemented to ensure data integrity, including:

(i) Implementation of events to secure the data besides unintended loss or damage, *e.g.* by usage of the methods such as replication or back-up and allocation to other storage system.

(ii) Implementation of processes to secure the data in contrast to altering or unauthorized manipulation. Physical and reasonable controls must be in a place to control access to computerized system to official persons. Appropriate methods of averting unlawful entry to the system might be include *e.g.* the usage of keys, pass cards, and personal codes with passwords, biometrics, or limited access to computer equipment and data storage areas. The range of safety controls rest on the complex-icity of the computerized system

(iii) Implementation of measures to ensure the accuracy, completeness, availability and legibility of documents throughout the retention period.[2]

Life data cycle

Data shall be maintained all through its lifetime. Along with data management required controls shall be maintained to diminish the risk to data at to each and every point in data lifecycle. This is a moral preparation to plan the data lifecycle which could be generated, processed and stored by using various computerized systems and by manual processes during data lifecycle.[3]
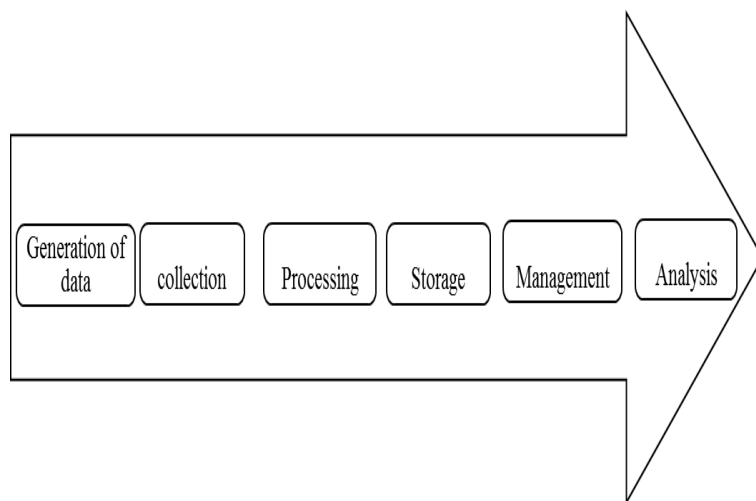

Figure 1 data life cycle

Out there analysis, data *Visualization* helps present results in a clear and simple way that a humans can readily understand and visualize.[4]

Is data integrity matters?

In the course of GMP examinations through the supervisors numerous violations in data modification and various data issues were recognized in pharmaceutical manufacturing facilities, predominantly ones centered in Asia. In 2016, a regulatory agency allotted 75 warning letters for a variety of violations counting unauthorized promotion, unsatisfactory registration, unauthorized distribution, technical violations and formulation quality violations. Among of those letters, 43% enclosed cases are Data Integrity violations.[5]

Warning letter and compliance issue

The threats of non-compliance grow along with the quantity of NDAs/ANDAs as well as facilities, as amplified scrutiny approaches with scale and regulatory authorities be there prepared to send warnings to several sites centered on the review of one site. A pharmaceutical manufacturer's handle to decrease the risk of regulatory action along with improving Data Integrity. Doing so may provide a sustainable advantage in a highly competitive market.

As Jan 2018 analysis by GMP (good manufacturing practices) intelligence expert, Barbara Unger, approximately 65 percent of all US Food and Drug Administration (USFDA) warning letters issued in FY2017 (October 1, 2016, until September 30, 2017) included a data integrity component.[6] In 2017, FDA released 476 warning letters.

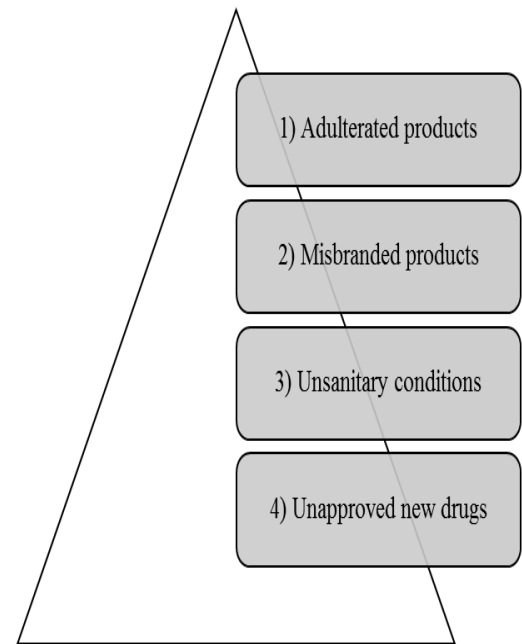Maximum Food and Drug Administration warning letter violations were following[7]

Figure 2 Types of violations

Out of above mentioned violations 32% are allotted to China besides In

Key challenges facing by the industries during implementation of data integrity practices

There are a widespread of challenges faced by the industries attempting to accomplish good data. These are following but not limited to:
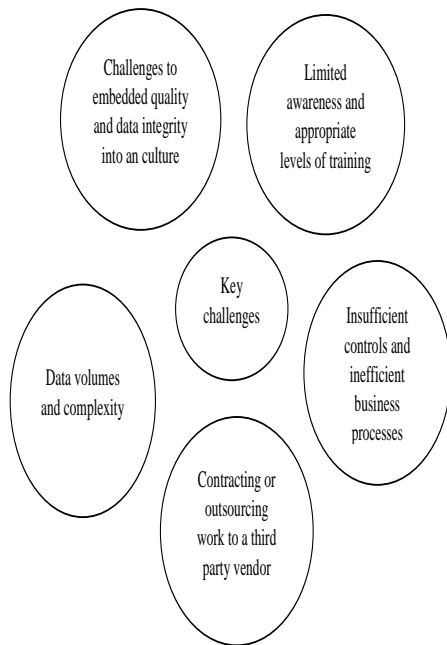
Figure 3 Key challenges facing by the industries

• Challenges to embedded quality and data integrity into a culture – industries realize the importance of data quality culture but they don't know how to accomplish it. 'Everyone is responsible for quality'. To maintain the quality culture of the data quality and integrity can be done by design and duty of the organization.

• Limited awareness and appropriate levels of training – An effective quality culture shall be raised and maintained only personnel are given the right resources to operate efficiently and effectively. It is important to assess and understand the type and level of training needs across the organization in order to ensure productivity. Now a days employees are pressured to deliver fastly in less time because of competition as a result employees cut corners and try to distribute with in time by give in quality and it indirectly inducing Data Integrity. Personnel must be made responsive of the true costs of deteriorating data quality and how it is effect the patients.

• Insufficient controls and inefficient business processes– To maintain the data quality and DI in industries organization must implement the quality systems like business process and robust controls. This shall be make sure that the data lifecycle is controlled and data is generated without compromising data quality in a timely manner along with consistency.

• Contracting or outsourcing work to a third party vendor – If a pharmaceutical company presently contract out work to additional third party, so that company might have the responsibility to maintain data quality used by the third party vendor. This is also applicable to data management by a third party like contracted IT data centers, database support personnel and cloud computing solutions. And it is also one of the risk in order to maintain the data quality.

• Data volumes and complexity – Data volumes in the life pharmaceutical companies are increasing suddenly upcoming from various data sources. Data must be collected, operated and textured for maintaining data quality and consistency by using numerous ways. Due to this industries are stressed with understanding, evaluating and transforming data in to expressive visions. The outburst in the volume and complexity of data about pharmaceuticals, patients, procedures and actions discloses data integrity threats in areas that remained previously safe. Lacking of data that is consistent, accurate and reliable across the inventiveness, an association can become less competitive, and less efficient.[9]

Good data management and governance (data integrity)

Data governance and data integrity (DI) are key features in certifying the reliability of data along with data obtained in manufacturing and Quality control (QC) of pharmaceutical products. The data and information must and should be thorough as well as being attributable, legible, contemporaneous, original and accurate, usually referred to as meeting "ALCOA" principles.[10]

Organization intend to proceeds wholly the measures with respect to subsequent components of Good Manufacturing Practices, those are supposed to be probable causes for data integrity concerns.

1. System design

2. Personnel

3. Documents/records

4. Equipment/ instruments

5. Computerized system

General considerations and expectations under each components are described below.

1. System design:

- ✓ Systems shall be intended to provide required measures that encourages compliance with the principles of data integrity and they must be designed in that way. Examples include but not limited to[8];
    - Access of timers for recording scheduled occasions.
    - Accessibility of batch records at localities where events take place so that data copy and later transcription to authorized records is not obligatory.
    - Governor over outright papers patterns for data recording.
    - User access rights to eliminate data modifications.
    - Use of computer systems having in built audit trail or appropriate controls.
    - Computerized data imprisonment or copiers devoted to equipments such as balances.
    - Access to raw data for personnel performing data checking activities.
    - Defining the responsibilities properly for the life cycle of being generated.
    - Designing forms/formats/batch manufacturing records in defined way that providing is made for all essential entries/critical operations.[11]

2. Personnel:

- ✓ Personnel must monitor online documentation practice for both paper records and electronic records to assure data integrity and educated occasionally.
- ✓ Organization shall make sure personnel are skilled to understand and differentiate among proper and improper manner, including deliberate, falsification and potential consequences.
- ✓ Key personnel, including managers, super visors and quality unit employees shall be educated in measures to prevent and detect and issues.[11]

3. Documents/records

- ✓ All documents must be prepared by the personnel who are subject matter expert or trained personnel in the area/activity.
- ✓ Control strategies must ensure that all records, including paper & electronic records are subject to second person review to make certain that all test results are appropriately reported.
- ✓ The review & approval of data including raw data must be handled through respective procedure, data review must also include a review of relevant metadata, including audit trail.
- ✓ Any attachment to document/record shall be referenced to original document.
- ✓ Original records & true copies might store the integrity (accurateness, totality, content & significance) of the record. Printed copies of original records possibly will be reserved in place of the original record, providing that a documented system is in residence to authenticate & record the integrity of the copy.
- ✓ Electronic signatures with required controls shall be preferred to use wherever applicable instead of handwritten signatures. An electronic signatures used with appropriate controls to secure the link signature with the related record fulfils this obligation.

- ✓ Data must be complete along with being accurate, legible, contemporaneous, original & attributable commonly termed as "ALCOA"
- ✓ **Attributable:** defined as data is grasped into the record so that it might be exclusively recognized as accomplished by the investigator of the data (examples: personnel, computer system).[12]

Table No: 1

Expectations for paper	Expectations for electronic
Attribution of activities in paper records must happen as appropriate done by the use of ✓ Initials ✓ Full hand written signatures	Attribution of activities in automated records must happen as appropriate done by the use of ✓ Unique user logons, that connected to the user to actions that generate, alter or remove the data ✓ Electronic signs (either biometric/non-biometric)

- ✓ **Legible, traceable & permanent:** The terms legible, traceable & permanent stated that the data shall readable, under standard able and permit a flawless image of the sequencing of events in the record so that entire GxP events accompanied can be completely reconstructed by individual reviewing these records at that point of recording. Retention period established by the appropriate GxP.[12]

Table No: 2

Expectations for paper	Expectations for electronic
Legible, traceable & permanent controls paper accounts comprise but are not limited to; ✓ Usage of everlasting, ineradicable ink ✓ Certainly not usage of pencil/erasers ✓ Usage of single-line or cross outs for record alterations along with signature, date & reason recorded ✓ Certainly no usage of dense rectification ink or else observing the record. ✓ Précised issuance of certain, paginated notepads with consecutively numbered pages. ✓ Précised issuance of serially numbered copies of blank forms ✓ Archival of paper documents by self-regulating, elected archival in protected & organized paper	Legible, traceable & permanent controls for electronic records comprise but are not limited to; ✓ Designing & organizing computer systems & scripting of SOP, as obligatory that impose the saving of electronic data during the time of the action and preceding to proceeding to the following step of the sequence of steps. ✓ Usage of protected, time imprinted in audit trails that autonomously record activist actions. ✓ Configuration settings & SOPs as required to disable & prohibit the capacity to over write data, including prohibiting over writing of preliminary & intermediate processing of data. ✓ Archival of electronic records in secure controlled electronic archives.

archive.	

✓ **Contemporaneous:** means data noted during the period of generation or observation.

Table No: 3[13]

Expectations for paper	Expectations for electronic
Contemporaneous recording of activities in paper documents might be occur as appropriate by the usage of; ✓ Written procedures, training review and self-inspection controls to make sure that personnel record data accesses & data during the time of activity straight into authorized controlled documents. ✓ Procedures must be involve that activities be recorded in paper records along with date of the doings (and time as well as,	Contemporaneous recording of activities into electronic documents must be occur as appropriate, by the usage of; ✓ Configuration settings & SOPs as essential, to impose the committing of electronic data to durable media during the period of the action & before scheduled to the next step in the succession events. ✓ Secure system time/date stamps that should not be manipulated by personnel. ✓ Procedures & maintenance programs that ensure time/date stamps are synchronized across the GxP operations; controls that allow for the discerning of the timing off one activity relative to another

if it is a time sensitive activity)	

✓ **Original:** That comprises the initial or source seizure of data or material & all succeeding data compulsory to completely restructure the behavior of the GxP doings. The GxP obligation for original data include:

- Original data must be reviewed.
- Original data or qualified true & precised copies that realm the pleased & significance of the original data must be retained.
- As much, original records must be thorough, durable and willingly retrievable & understandable during the course of the records retention time

Table No: 4[13]

Expectations for paper	Expectations for electronic
Controls for assessment of original paper documents consists but not limited to; ✓ Written procedures, training, review &self-inspection controls that make sure that employees behavior on suitable review & authorization of original paper records. ✓ Should make sure that person-	Controls for review of original electronic documents include, but not limited to; ✓ Inscribed events and training, review and audit inspection controls that make sure employees conduct an passable review and authorization of original electronic records, including human understandable source records of electronic data. ✓ Data review operations must define re-

nel assess deviations made to original information on paper records to make sure these changes appropriately documented and justified with sub-staining evidence and examined when obligatory. ✓ Data review must be recognized manually this is characteristically shown by signing the papers those has be reviewed.	view of original electronic data & relevant metadata. ✓ Data review must be acknowledged for electronic data, this is characteristically meant by electronically authorization the electronic data set that must be reviewed and approved.

✓ **Accurate:** The term accurate means data are correct, truthful, valid & reliable for both paper and electronic records, achieving the goal of accurate data requires adequate procedures, processes, systems & controls that comprise the QMS.[13]

4. Equipment/Instruments:

✓ Equipment/instrument must be qualified for the intended use & shall be proved fit for entire operating range.

✓ During procurement of equipment/instrument it shall be ensured that equipment shall have PLC or other logging controls based on criticality of usage.

✓ Vendor must be instructed qualification of logs as part of equipment qualification.[13]

5. Software/Computerized system:

✓ Software/computerized system procurement/validations shall be in-line with industry computer system validation procedures.

✓ Suitable controls must be implemented to assure that solitary authorized personnel shall make changes for automated records or input laboratory documents into computerized records and documented controls must be applied to ensure actions are attributable to a precised individual.

✓ Computer systems must be designed to make sure that the implementation of critical processes are recorded contemporaneously by the operator and are not joined into a particular computer system transaction with other operations.

✓ Shared logins/ generic user access should not be used. Where the computerized system design supports individual user access, this function must be used.

✓ Complete usage should be through the access controls to make sure that personnel have access only up to appropriate for their job role, that activities are attributable to a particular individual.[8]

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