# Statistical and Accounting Survey of the Prevalence of Pathogenic Bacterial Strains and their Antibiotic Resistance Pattern in Hospitals and Diagnostic Laboratories in Benin City, Nigeria

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***Abstract***
*This survey determined the prevalence of pathogenic bacterial strains and their antibiotic resistance pattern in Government hospitals, private hospitals and diagnostic Laboratories in Benin City between 1986-1988. In the survey, a total of one thousand, eight hundred and twenty four (1,824) bacterial strains were recorded out of which staphylococcus strains exhibited the highest prevalent clinical isolate with 611 isolates or (33.5%) and is quickly followed by Escherichia Coli 333 (18.3%), Klebsiella Specie 231 (12.68%), Streptococcus spp 145 (7.9%) , Neisseria gonorrhoea 138 (7.6%) and Pseudomonas aeruginosa 132 (7.2%). The study shows that the resistance of these strains to the Nine commonly used antibiotic in Benin City, Nigeria were very high. Of the Staphylococcus aureus isolates, amplicillin resistant strains has the highest (8.75%) closely followed by tetracycline, Erythromcycin, Methicillin-, Nitrofurantodin-, and gentamicin- resistant (78%, 71%, 62.5%. 56%, 39%, 28%, 7%, 3% respectively. This same trend is almost true of Escherichia coli isolates. Pseudomonas aeruginosa isolates, 96% were ampicillin resistant, closely followed by Tetracycline, Chloramphenicol, Erythromycin, Cotrimaxazole, Stretptomycin-, Methicillin-, Nitrofurantoin-, and gentamicin-, resistant (90%, 87%, 73%, 70%, 20%, 15%,2% respectively). Proteus closely resemble the isolate pattern for Psendomonas aeruginosa and Klebsiella specie. Finally, Neisseria gonorrhea isolates, ampicillin is highest with tetracycline-, cotrimaxazole-, Nitrofurantoin-, (66%, 30%, 18% respectively). None was methicillin and gentamicin resistance.*

***Keywords:*** *Pathogenic, bacteria, antibiotics, accounting survey, resistance*

## 1. Survey Background

Knowledge of infections and diseased is dated back to Hippocrates, a Greek Philosopher in the fifth century before Christ; however the history of antibiotic therapy started with Louis Pasteur for more than a century and two decades ago, scientific work by Sir Fleming and Prof. Chain in 1923 and 1940 respectively led to the mass-production of antibiotics by the United States' Pharmaceutical industries thereby saving the lives of thousands of people from the military and allied servicemen at the end of the world war II. Following this discovery a

decreasing mortality and fatality rates was reported for many infections (Wilson, D. 1975, Simmons, H. E. & Stolley, P. D. 1974).

As a consequence of the use of this remarkable popular class of drugs irrespective of its dramatic benefits, new and major hazards had emerged due to its inappropriate usage with consequent shift in the bacterial ecologic equilibrium, emergence, spread and persistence of drug- resistant bacterial strains, change in incidence and severity of nosocomial infection (Simmons, H.E. and Stolley, P.D. 1974). Bacterial resistance which is a phenomenon observed as decreased in the suspectibility of hitherto susceptible, micro-organisms to antibacterial agents, thus a particular infection caused by a bacterial strain could no longer a treated with the initial inhibitory concentration of dose.

A number of researches as well as publications in learned journals on the growing use of antibiotics in Nigeria had pointed out the unpleasant emergence of antibiotic resistance in Nigeria. Commenting on this growing trend, the World Health Organsation (WHO) memoranda on the Scientific working group on antimicrobial resistance meeting in Geneva 1981 prescribed the measures for controlling this prevalence, which amongst other things included – the surveillance of antibiotic resistance (Human pathogen and human assistance determinants) and control of antibiotic use in hospital (establishment of hospital antibiotic policy) (ROTIMI, V. O. 1981, Iserhienrhien, F. A. 1987, WHO Scientific bulletin, 1983). Workers in the recent past have equivocally shown that prescription and use of antibiotics in health institutions are without benefit of accumulated experience of bacterial cultures or bacterial sensitivity testing in United States, Britain and Russia (Rebecca, M. 1965, Navashin 1979, Sheckler etal, 1970, Reberts, A. W. etal 1972) – based on this situation, the danger posed by the use of these 'wonder drugs' in the third world nations Niigeria inclusive can best be understood in the light of the intensive study carried out by Obaseiki-Ebor etal 1987 reporting the escalating misuse and abuse of antibiotics among health institutions and the general public. Without doubt it is evident that this anomally is causing health authorities and research scientists in the medical and pharmaceutical world a big concern (whitehead, J.E.M. 1973).

**1.2 Bacteria Resistance to Antibiotics**

The efficiency of antibiotics are on the decline leading to the search for strategy and tactics of combating the resistance phenomenon. There are two types of resistance of bacteria to antibiotics namely inherent and acquired (Hugo, W.B. etal 1980, Akhigbe, I.D. 1987, Navashin, 1979).

In inherent resistance, the bacterial strains are resistant to the antibiotic on first exposure, the gram negative bacteria which as a group are inherently resistant to a number of important antibiotics that are effective against Gram positive organisms. Within Gram negative group Pseudomonas acruginosa presents a special intractable resistance to many antibiotics because of its Intrinsic property – cell wall constitution. Gram negative bacteria is associated with the impermeability of the complex outer layer of the cell envelope to some drugs, which prevents the attainment of an inhibitory concentration within the cell (Brown, M.R.W. (Ed), Hugo W.B. etal 1980).

For acquired resistance, it is genetically based through mutation, transduction process (plasmid-mediated-the R – factor transfer even amongst species or general that one different

– affecting a wide range of organisms. The R- factor may carry the determinants for drug resistance for as many as nine compounds result in the multiple drug resistance (PEN. R.G. 1974). A report has confirmed the multiple resistance phenomenon in Nigeria for clinical isolates of E. Coli, Klebsiella and Proteus Specie.

The tremendous capacity at which micro-organisms circumvent the action of inhibitory drug might continue unabated since attempts to control resistance and limit its impact have only been partially successful and virtually every new drug or antibacterial in sooner or later threatened by the emergence of resistant strains, Scudamore, R.A. etal 1974.

In 1959, Multiple resistance to Chloramphenicol tetracycline, streptomycin and sulphonamide was reported in the strain shigella flexneri thereby illustrating the occurrence of multiple – resistance. (Sharma K. B. etal 1979). Its versatility has expanded to include ampicillin, kanamycin, chloramphenicol, streptomycin, tetracycline, sulphonamide, penicillins amongst numerous others giving concern to medical authorities (Eniojuka J. F. etal 1989, Joklik W.K. etal 1976).

### 1.3 Aims of the Study

This study is a retrospective survey of the prevalence of pathogenic bacteria and their antibiotic resistance patterns in Government hospital, private hospital and diagnostic laboratories in Benin City between 1986 – 1988. The Study is aimed to give an insight into the prevalence and the antibiotics susceptibility pattern of the pathogenic bacterial isolates. The results are expected to indicate the antibiotics that are still effective in the treatment of bacterial infections.

## 2. Methods

Collation of records of result of the laboratory tests in three government hospitals, four private hospitals and diagnostic laboratories were carried out for the period 1986-1988. Compilation was done on the different organisms isolated and the antibiotic to which each was resistant to. A total of one thousand, eight Hundred and Twenty four (1,824) bacterial isolates and their antibiotic resistance pattern were studied by counting the number of isolates that were resistant to a particular antibiotic. For the three years 1986, 1987, 1988, the total bacterial isolates recorded were 546, 616, 662 respectively. The following bacterial species commonly associated with infectious in this area of study, namely, Staphylococcus aureus, Strepto coccus spp, proteus spp and Psiudomonas aerugiuosa were of interest.

The antibiotics considered were also those commonly used in this area. These includes Ampicillin (PN), Tetracycline (TE), Chloramphenicol (C), Erythromycin (E), Cotrimaxazole (SXT), Streptomycin (S), Nitrofurantoin (F), Methicillin (CB), and Gentamicin (G). An analysis involving the use of tables and bar diagrams to clearly show the relationship between the antibiotic resistance patterns and their prevalence during the three years period was precisely put down.

## 3. Results

### Prevalence of the Bacteria Pathogens

A total of one thousand, eight hundred and twenty four (1,824) isolates recorded from three Government hospitals, four private hospitals and diagnostic laboratories in Benin City were analyzed. The prevalence of the different isolates studied between 1986 and 1988 are

presented in figure 1 in bar diagrams.

Based on the result obtained from figure 1 in 1986, Staphylococcus aureus toped the list of the seven common bacterial pathogenic bacteria with (173) isolates), Escherichia Coli followed having 126 isolates, Proteus specie (71 isolates), Klebsiella specie (66 isolates), Streptococcus specie (41 isolates), Neisseria gonorrhoea (32 isolates), and Pseudonionas aerucinosa (32 isolates).

In 1987, the most prevalent pathogen was staphylococcus aureus with a total of (218 isolates) followed by Escherichia coli with (114 isolates), Neisseria gonorrhoea (56 isolates), Streptococcus specie (47 isolates) and Psendomonas aeruginosa (43 isolates). 1988 saw staphylococcus aureus the most prevalent with (220 isloates), Klebssella specie followed with (109 isolates), Escherichia coli (93 isolates), proteus specie (81 isolates) Psiudomonas aeruginosa (67) isolates), streptococcus specie and Neisseria gonorrhea (45 isolates). 1998 showed varied trend by Klebsiella spp following immediately after Staphlococcus aureus instead of Escherichia coli as in the previous years. Pseudomonas aeruginosa also changed position from being the last to being the fifth predominant with (67 isolates).

The observations showed that for most pathogens there was a gradual increase in number from 1986 to 1988. For Staphlococcus aureus there was a gradual increase from (173 isolates) in 1986, to (218 isolates) in 1987 and then 220 isolates in 1988. For E Coli it is decreasing from (126 isolates) 1986; (114 isolates) 1987 to (93 isolates) 1988. Klebsiolla showed a rise from 66 isolates of 1986, 59 isolates of 1987 to 109 in 1988. For Streptococcus specie it was a strepwise increase from (41 isolates of 1986, 47 isolates) 1987 to (57 isolates) of 1988. Neisseria gonorrhoea was rather similar to proteus (71 isolates) – 1986. (79 isolates) 1987 and (81 isolates) 1988, for streptococcus specie same situation was obtained.

Antibiotic Resistance pattern of the Pathogens
Nine antibiotic clinically commonly tested for bacterial sensitivity tests in private and government hospitals microbiological laboratories were examined. They were ampicillin (PN), Tetracycline (TE), Chloramphenicol (C), erythromycin E, Cotrimoxazole (SXT), Methicilin (CB), Nitrofurantoin (F), Streptomycin (S) and gentamicin (GN), others which are effective and commonly used include colistin (CT), Ciprofloxacin (CIP), Rocephin CR), Carbenicillin Cefotaxime, Ceftriaxone, Moxalactam were rare during the period of study.

Figure II to IX showed the antibiotic resistance patterns of the bacteria pathogens 1986 and 1988.

In figure II, the highest number of resistant **staphylococcus aureus** isolates were recorded against ampicillin (PN) in 1986 with a total 151 resistant isolates followed by tetracycline (TE) with 135 resistant isolate; cotrimaxazole SXT (123 isolates), streptomycin (108 isolates) Chloramphenical (97 isolates), Erythromycin (68 isolates), methicillin (48 isolates), Nitrofurantoin (12 isolates), and gentamicin (5 isolates) representing 87.5%, 98%, 71%, 62.5%, 56%, 39%, 28%, 7% and 3% respectively. The same gradation occurred in 1987 with Staphlococcus aureus being the most prevalent resistant strain to the antibiotics (Fig. 11).

1988 ampicillin – resistant **Staph aureus** (193 isolates) (87.5%) emerged the most common followed by the **Staphlococcus aureus** isolate respectively resistant to the following

antibiotics tetracycline, cotrimazazole, strephtomycin, chloramphenical, Erythromycin, methicillin, Nitrofurantoin and gentamicin in decreasing order (Fig. 11).

Figure III shows the antibiotic resistance pattern or E.Coli between 1986 and 1988. in 1986 and 1987, the antibiotic to which the highest number of E.Coli resistant strains occurred was ampicillin (PN) followed by SXT, TE, E, C, S, CB, F and CN.

Fig. IV shows the antibiotic resistance pattern of **Pseudomonas aeruginosa** between 1986 and 1988. As before all the isolates were resistant to all the antibiotics in the three years. In 1986, 1987, and 1988 ampicillin (PN), emerged the highest with 31 resistant strains, followed by TF, C, E, SXT, S, CB, F, and CN.

Fig. V shows the antibiotic resistance pattern of Proteus **species** between 1986 and 1988. In 1986 and 1987, ampicillin (PN) and TE emerged the highest resistant with 64 isolates, followed closely by SXT, E, C, S, CN, F and CB – resistant strains. The least resistance was obtained from methicillin with only one resistant strain. Figure VI shows the antibiotic resistance pattern of **Klebsiella SPP** between 1986 and 1988. In the three years PN – resistant strain were the highest, the least resistant became CN. There is a general stepwise – down ward decrease in the pattern of resistance occurred. Figure VII shows the antibiotic resistance pattern of **Streptococcus SPP** isolated between 1986 and 1988. There was a marked deviation from the usual high prevalence of PN –resistant strains in this case they were relatively few. For 1986, the highest prevalence was taken by TE – resistant strains (34 isolates) followed by C, SXT, S, CN, E, and F – resistant strains CB – resistant strain of **Streptococcus spp** was absent. 1987, TE – resistant strain emerged the highest followed by strain resistant, C, SXT, S, E, CN and F. In 1988 TE led in **Streptococcus specie** resistant isolates followed by C and the least was F. It was noticed that there was increased in the CB resistant isolate in this specie as compared to the previous analysis except for **Proteus SPP** resistant Strain where CB – had a resistant strain up to 60% pf the total. Figure VIII shows the antibiotic resistant pattern of **Neisseria gonorrhoea** isolated between 1986 and 1988. PN – resistant strain was the most prevalent followed by TE, SXT, E, C, and F in that order. It was remarkable that CB and CN – resistant strains of **Neisseria Gonorrhoea** were absent. However, the value of Nitrofurantoin resistant strain was high compared to below 10% usually exhibited in other pathogenic Bacteria such as analysed earlier except for Eroteus specie as shown earlier.

Generally, on analysis of the result obtained between 1986 and 1988, the summation showed that out of 611 **Strephylococcus aureus** isolated, 87.5% were ampicillin – resistant, 78% were Tetracycline resistant, 62.5% were Cotrimaxazole reistant, 56% were Chloramphenicol resistant, 39% were Erythromycin resistant, and 3% were gentamicin resistant. Out of 333 Escherichia Coli isolated 91% were ampicillin resistant, 76% Tetracycline resistant, 80% Cotrimaxazole – resistant 60% chloramphenicol – resistant, 53% Streptomycin, 71% were Erythromycin resistant 20% were methicillin resistance 20%, 2% Nitrofurantoin and 1% gentamycin. For Pseudomonas, a total 132 isolates were examined, out of which 96% were ampicillin, 90% were tetracycline resistant, 70% cotrimaxazole – resistant, 87% Chloramphenicol, 73% Erythromycin – resistant, 20% Streptomycin, 15% methicillin, 10% Nitrofurantoin resistant, 2% gentamicin – resistant. For Proteus specie out of total 231, (90%) were ampicillin – resistant, same with tetracycline with 90%, 84% Cotrimaxazole – resistant. 93% Erythromycin – resistant, 66% Chloramphenicol – resistant, 61% Stroptomycin –

resistant, 60% gentamicin – resistant, 20% Nitrofurantoin – resistance and 1% methicillin – resistant. Out of a total of 234 **Klebsiella Specie** isolated, 88% were ampicillin – resistant, 71% Tetracycline resistant, 63% Cotrimaxazole resistant, 60% Chloramphenicol – resistant, 55% Erythromycin – resistant, 18% Streptomycin – resistant, 11% Methicillin resistant, 5% Nitrofurantoin – resistant, 2% gentamicin resistant. Out of a total of 145 isolates of Streptococcus specie, 82% were Tetracycline resistant, 71% Chloramphenicol resistant, 18% Erythromycin – resistant, 14% ampicillin resistant, 20% gentamicin resistant, 10% Nitrofurantoin – resistant. There was no methicillin resistant strain. Out of a total 138 isolates of Neisseria gonorrhoea 76% were ampicillin resistant, 66% Tetracycline resistant, 30% Cotrimaxazole resistant, 22% Streptomycin and 18% Nitrofurantoin resistant. There were no methicillin and gentamicin resistane strain for Neisseria gonorrhoea.

From all indications, this general analysis show that ampicillin, tetracycline, cotrimaxazole, chloramphenicol resistant strains were the most prevalent (in most cases above 60%) for the seven pathogen examined except **Strephtococcus Specie** where the value for ampicillin was relatively low. However for Streptomycin, resistance the results showed it was on the average. Methicillin, Nitrofurantoin and gentamicin – resistant strain were few (always less than 29% except in Proteus Specie where gentamicin –resistant strains was high.

**TABLE I**
**PREVALENCE OF RESISTANT PATHOGENIC BACTERIA IN BENIN CITY 1986 – 1988.**

| PATHOGENIC BACTERIA | 1986 | 1987 | 1988 | TOTAL |
|---|---|---|---|---|
| Staphalococcus eureus | 173 | 218 | 220 | 611 |
| Escheriochia coli | 126 | 114 | 93 | 333 |
| Klebsiella Spp | 66 | 59 | 109 | 234 |
| Proteus Spp | 71 | 79 | 81 | 231 |
| Streptococcus Spp | 41 | 47 | 57 | 145 |
| Neisseria gonorrhea | 37 | 56 | 45 | 138 |
| Pesudomonas aeruginosa | 32 | 43 | 67 | 132 |
| Total | 546 | 616 | 662 | 1,824 |

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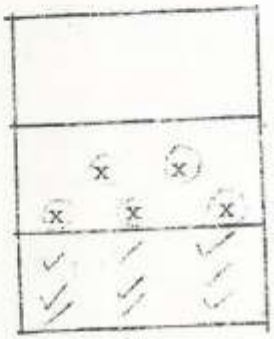
KEY TO FIGURES




KEY TO ANTIBIOTICS USED

| | | |
|---|---|---|
| PN | – | AMPICILLIN |
| C | = | CHLORAMPHENICOL |
| E | – | ERYTHROMYCIN |
| TE | – | TETRACYCLINE |
| SXT | – | COTRIMAXOZOLE |
| CB | – | METHICILLIN |
| CN | – | GENTAMICIN |
| F | – | NITROFURANTOIN |
| S | – | STREPTOMYCIN |

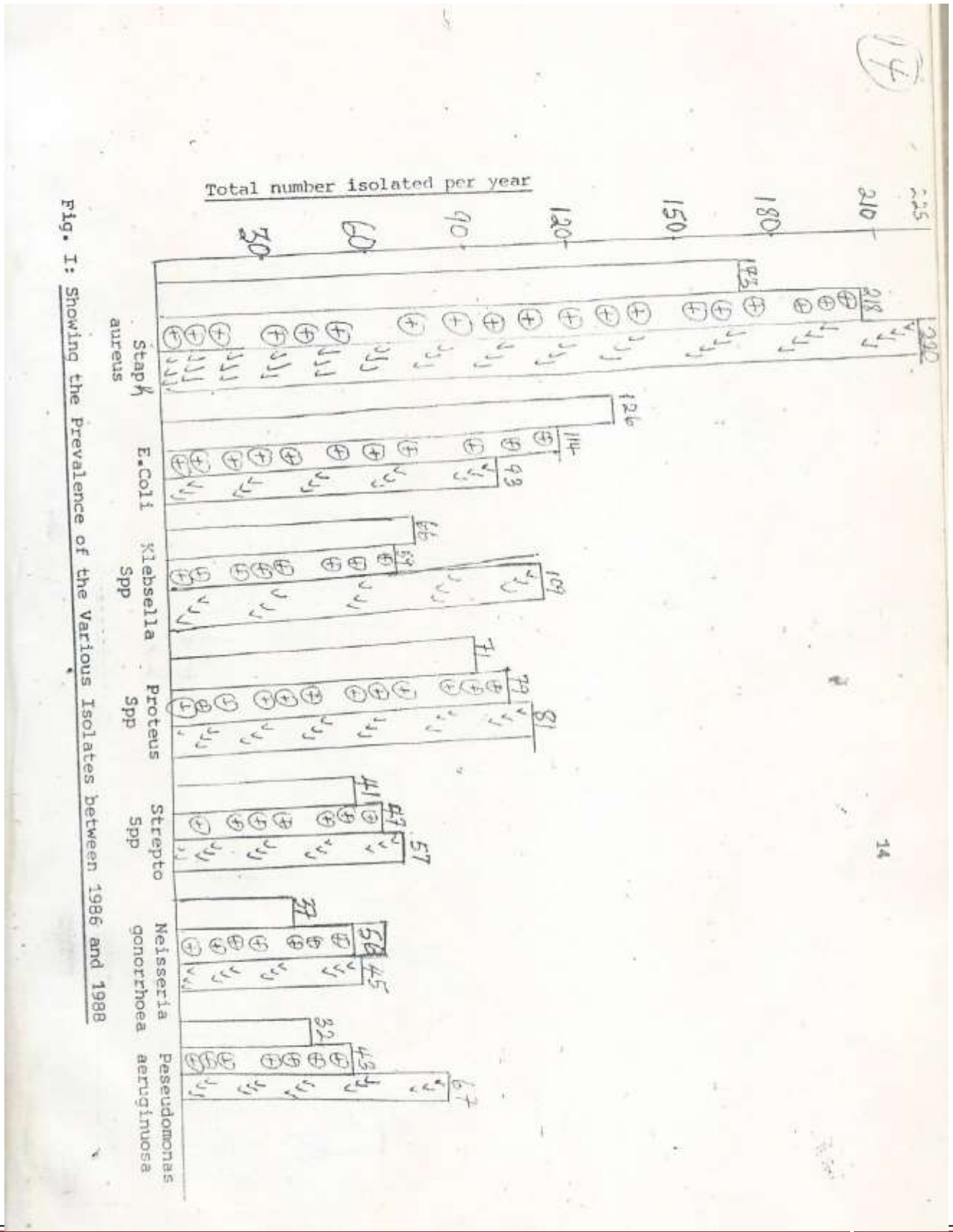



Fig. I: Showing the Prevalence of the Various Isolates between 1986 and 1988

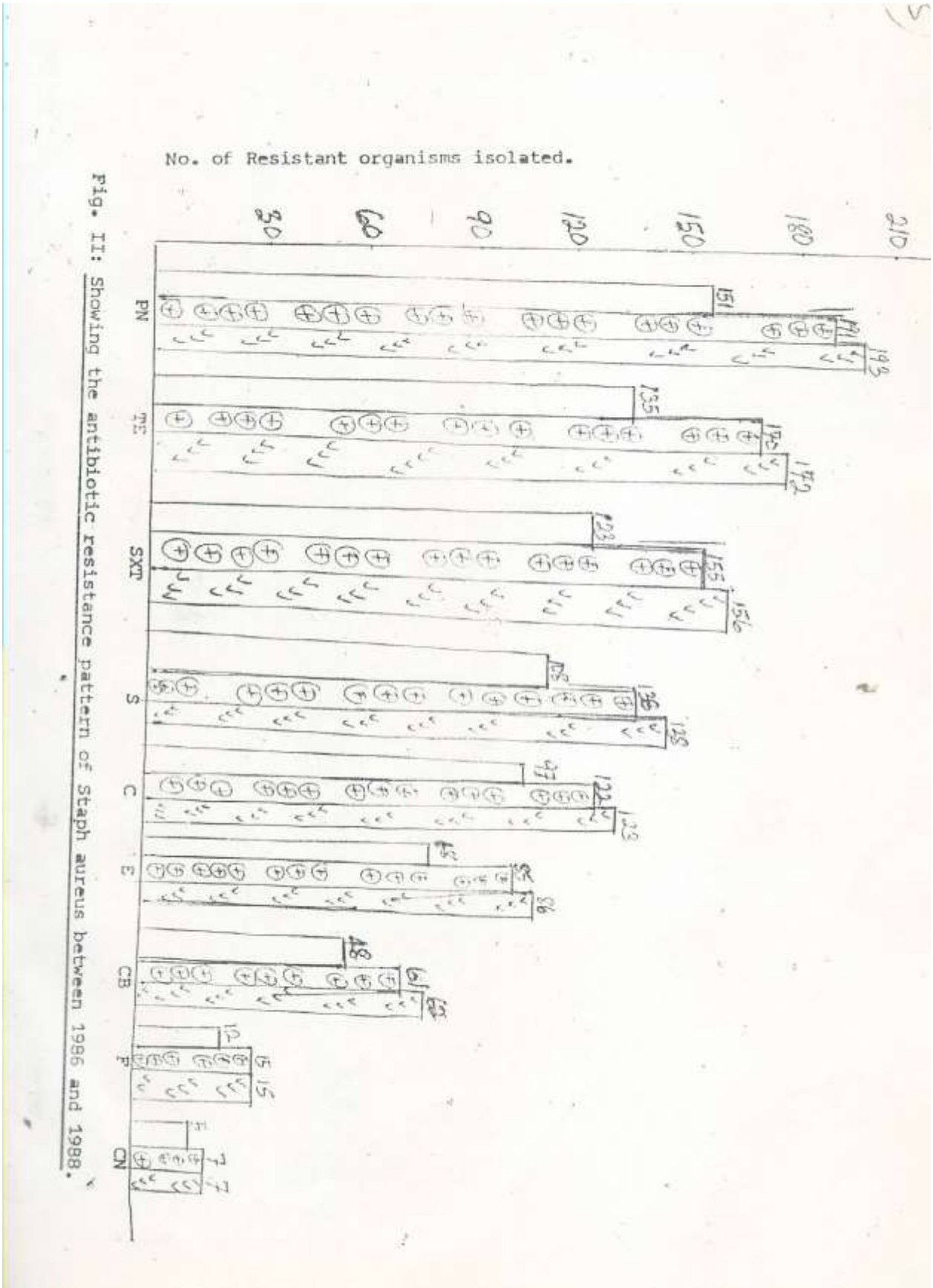



Fig. II: Showing the antibiotic resistance pattern of Staph aureus between 1986 and 1988.

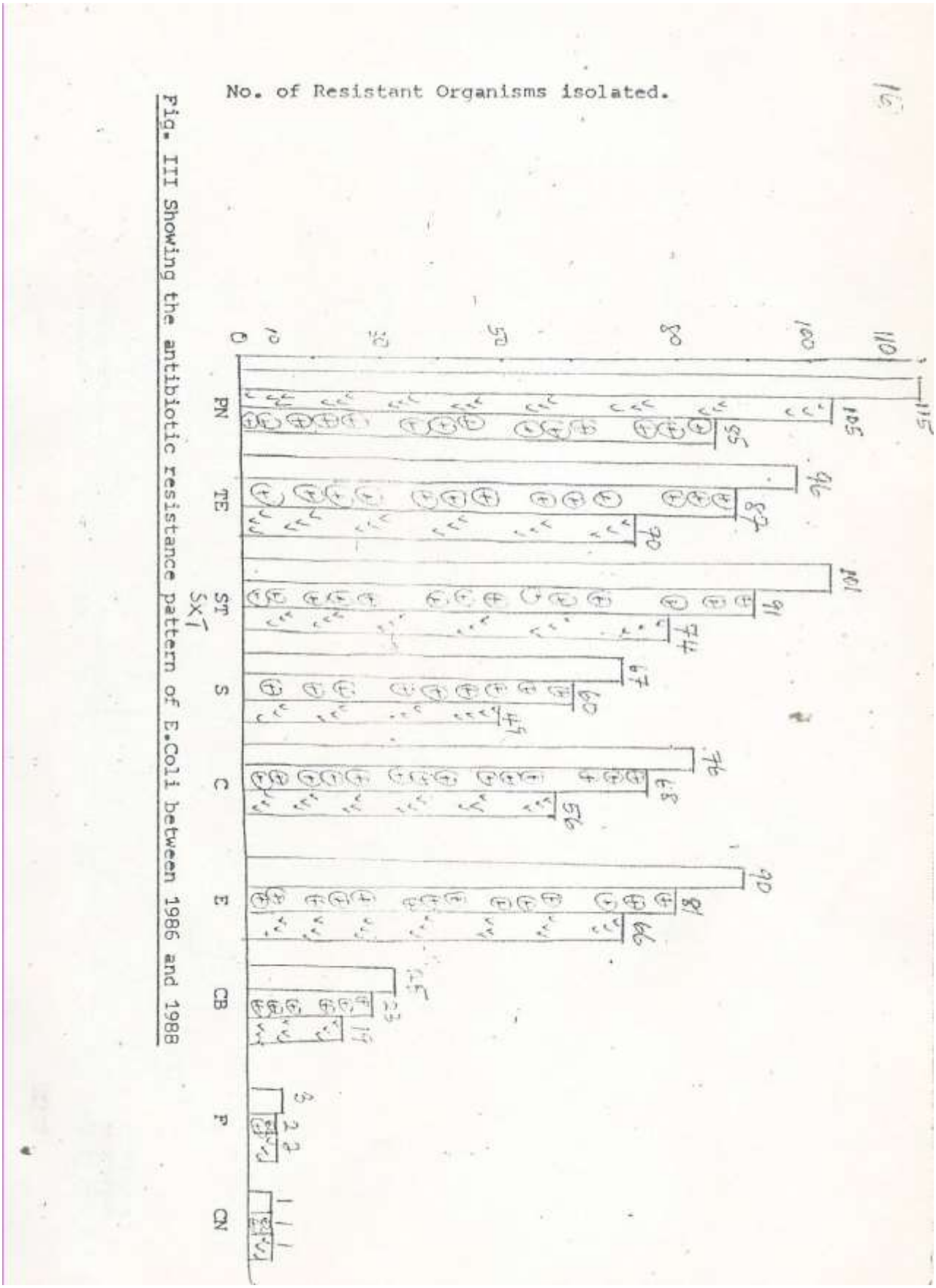



Fig. III Showing the antibiotic resistance pattern of E.Coli between 1986 and 1988

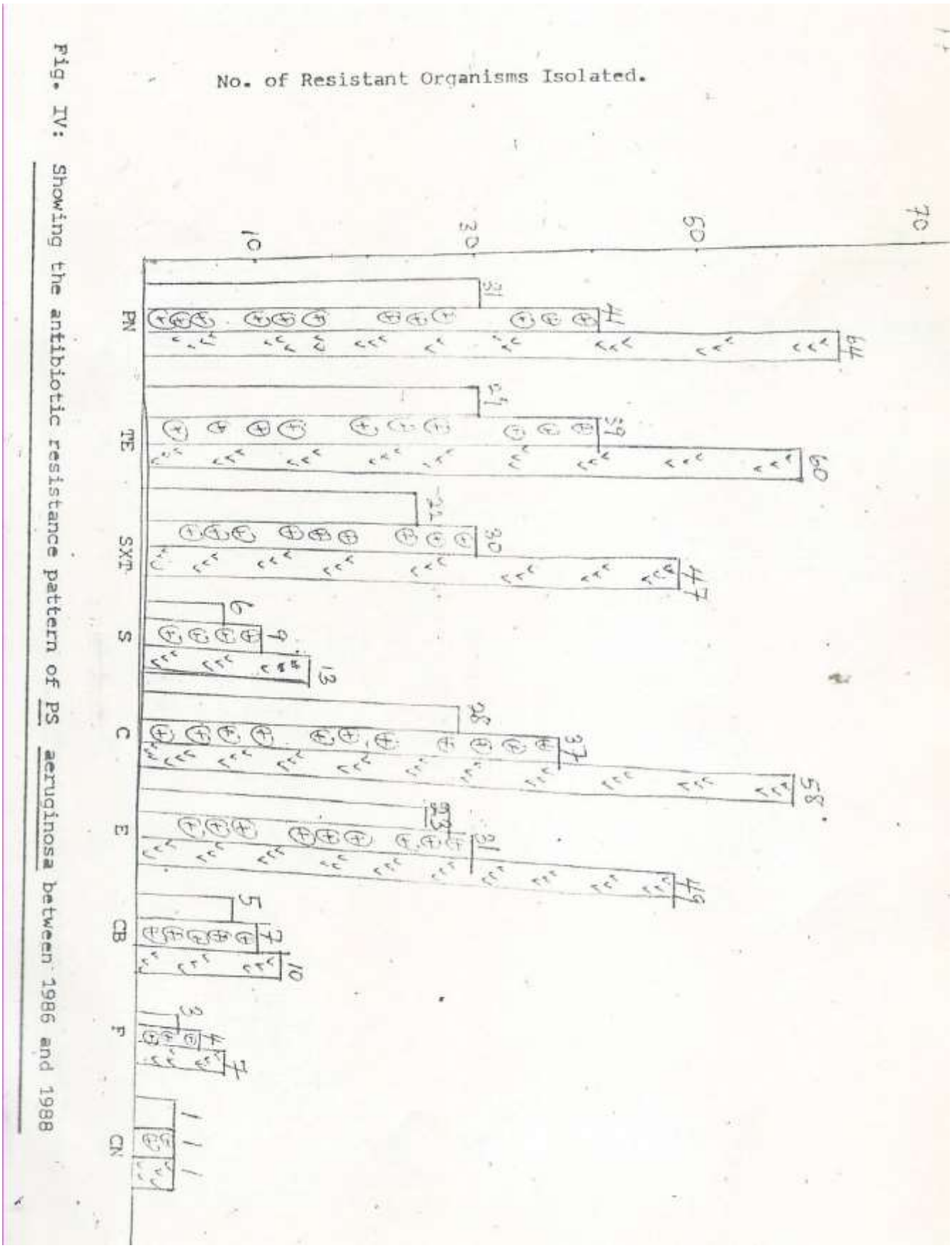



Fig. IV: Showing the antibiotic resistance pattern of PS aeruginosa between 1986 and 1988

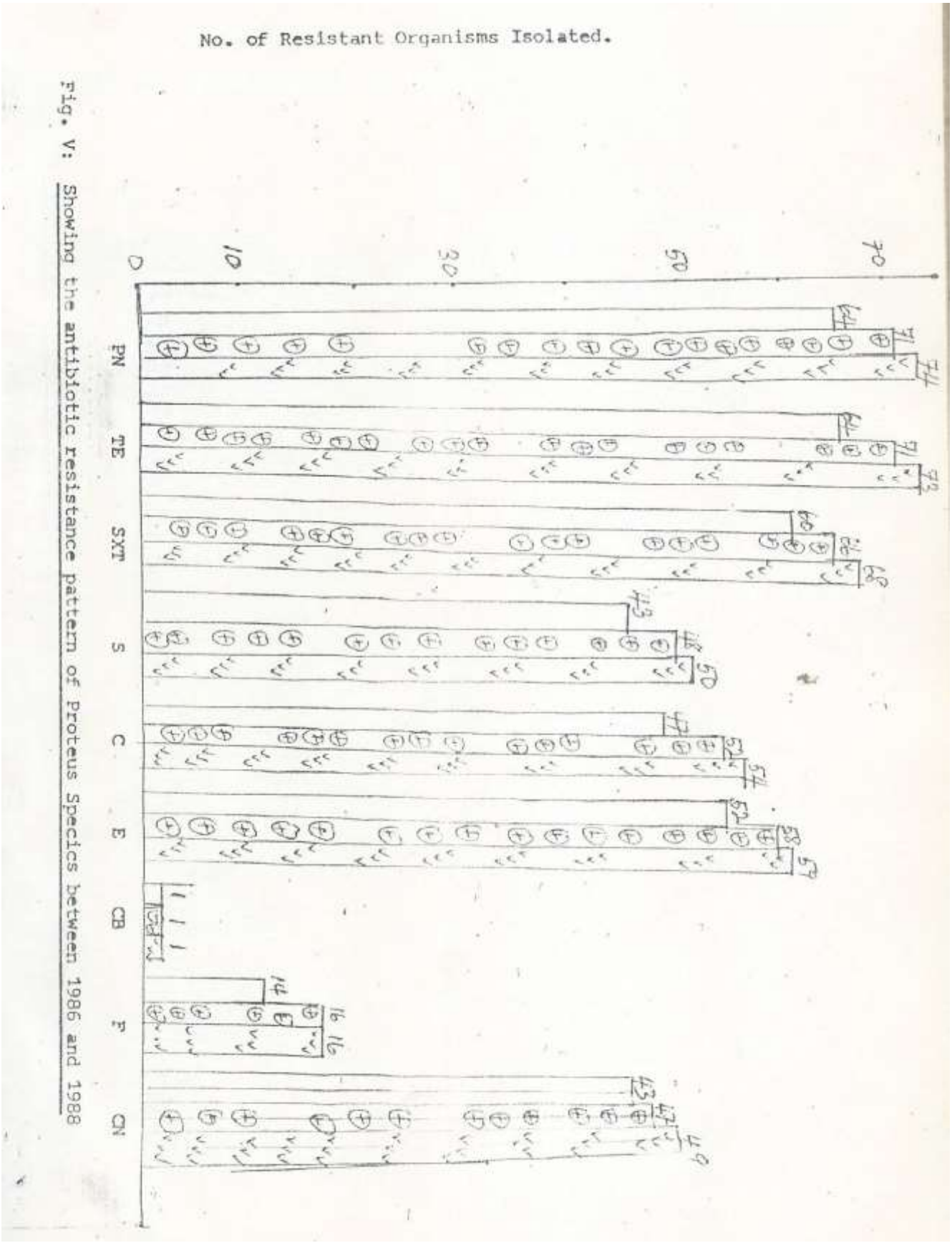



Fig. V: Showing the antibiotic resistance pattern of Proteus Specics between 1986 and 1988

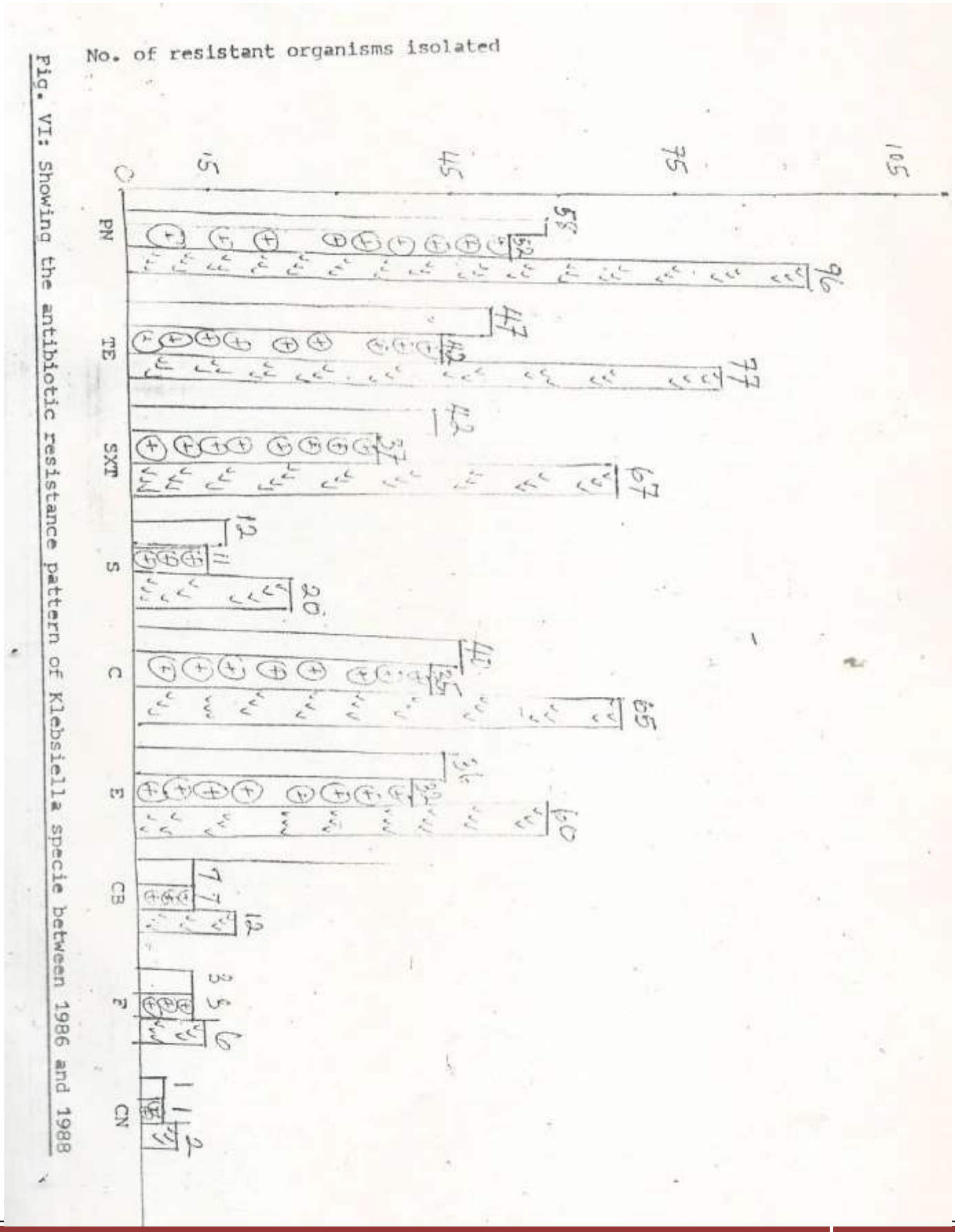



Fig. VI: Showing the antibiotic resistance pattern of Klebsiella specie between 1986 and 1988

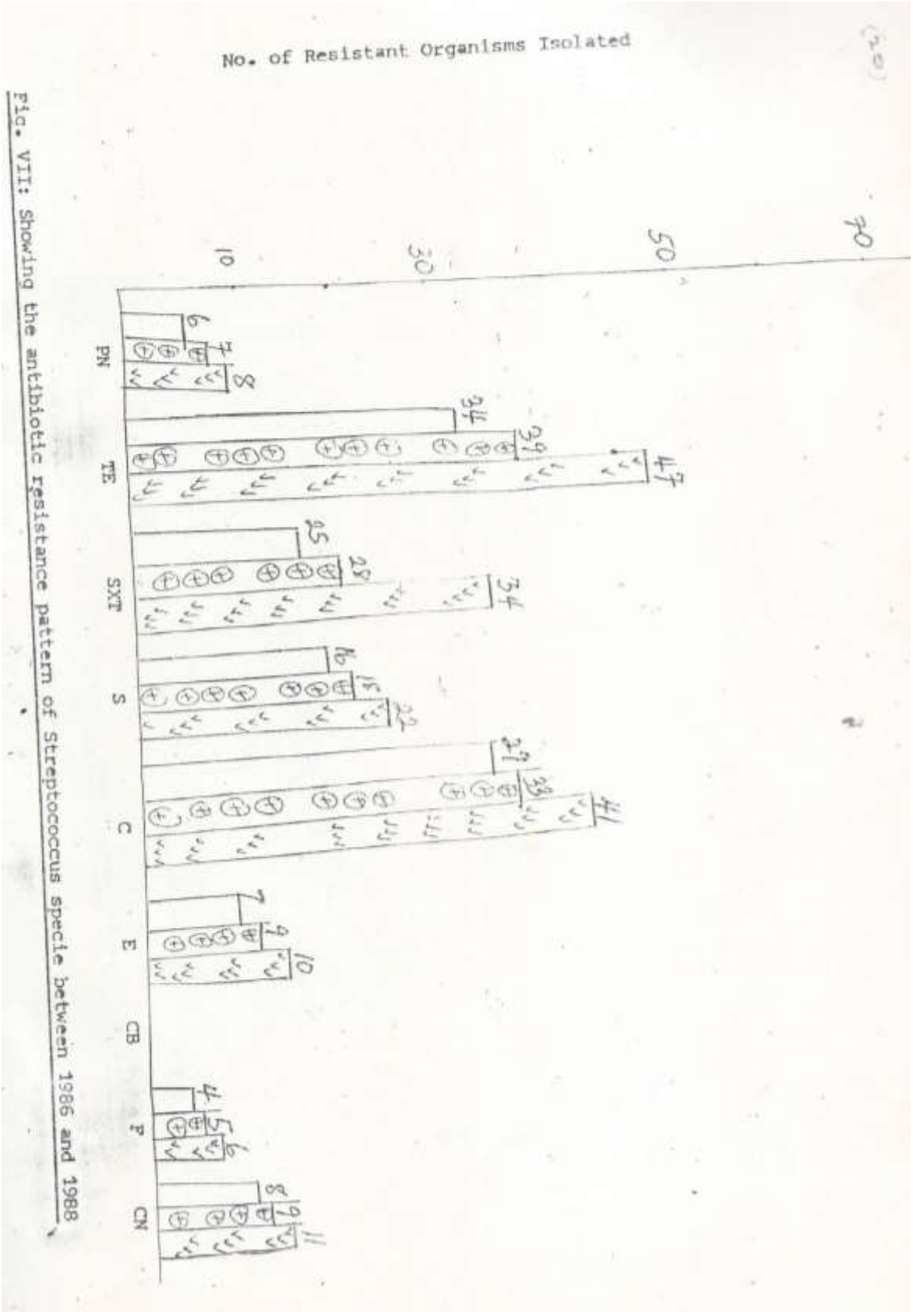



Fig. VII: Showing the antibiotic resistance pattern of Streptococcus specie between 1986 and 1988

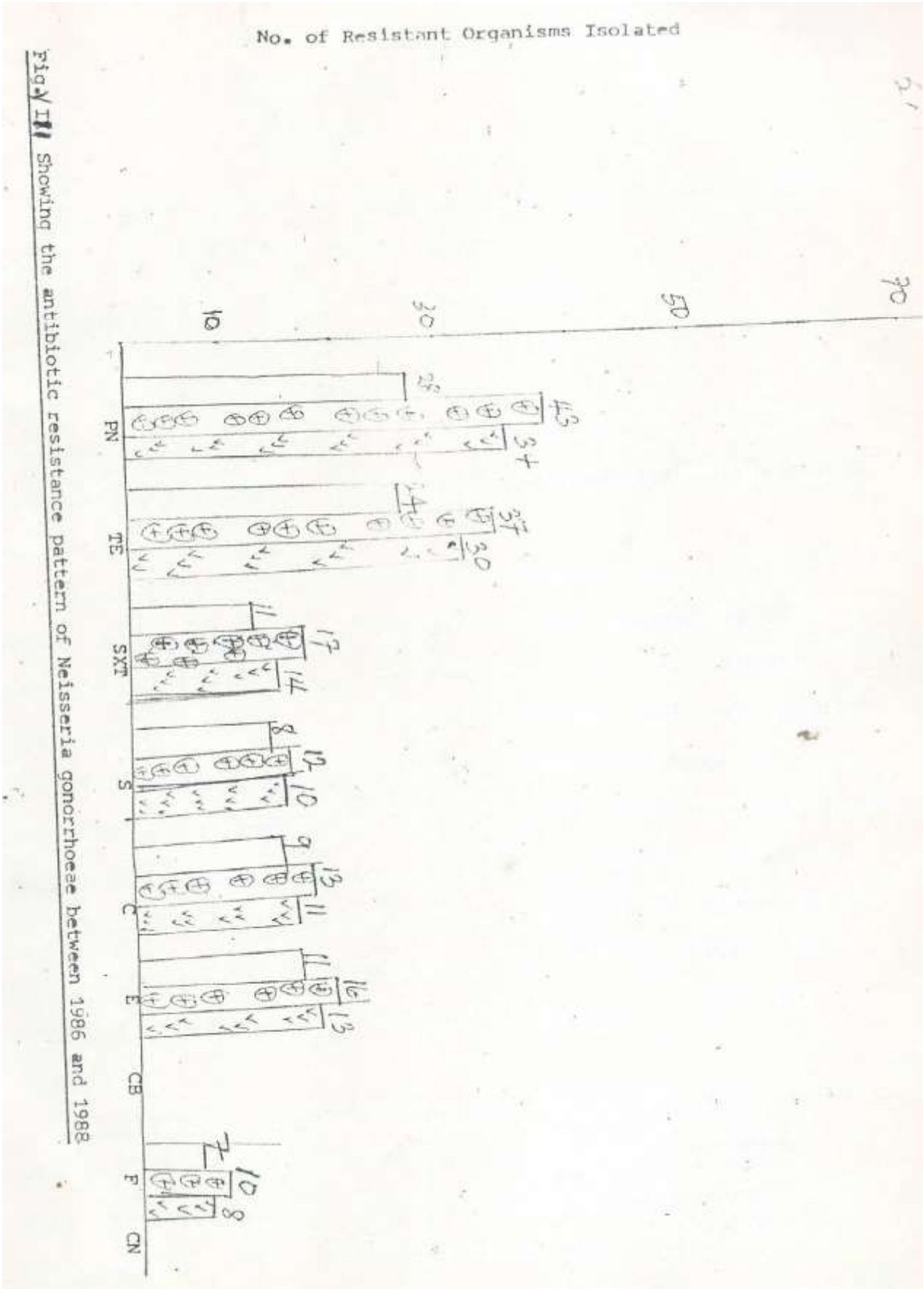



Fig.V III Showing the antibiotic resistance pattern of Neisseria gonorrhoeae between 1986 and 1988

## 4. Discussion of findings

This study confirms that **Staphylococcus aureus** a Gram – positive cocci was the most prevalent clinical bacteria pathogen in Benin City between 1986 and 1988. This is to be expected as it is responsible for over 80 percent of the suppurative infections of the skin but also may produce other severe infections such as respiratory infections, producing absceses, obstruction of pulmonary lung parenchyma – Staphyloccal pneumonia, osteomyelitis, pyoarthritis and food poisoning.

There is also a high indication in the study that resistance exhibited by Staph aureus to antibiotic is multiple such as to ampicillin, tetracycline and cotrimaxazole. It is observed that approximately 80% of the Staphylococcal infections acquired in the hospital and about 30% acquired in the Community are caused by penicillinase – resistant organisms (Joklik *et al.* 1976). This is easy to explain as indiscriminate use of ampicillin, tetracycline and cotrimaxazole in suspected infections has been clearly demonstrated in the work of Obasekike-Ebor, *et al.* 1987. The result is massive selection of multiple resistant strains in Benin City.

Escherichia Coli, which is a Gram negative organism is also among the clinically prevalent organism seen during the study. This organism is know to occupy a unique position amongst opportunistic enteric bacilli and certain strains cause primary intestinal disease as well as extra – intestinal infection, being the most common cause of Urinary tract infections in hospital and the community, most frequent cause of Gram – negative sepsis, and also have been isolated from cerebrospinal fluids and wounds even in cases of pneumona and in infant meningitis.

Klebsiella Specia, also a Gram negative organism was amongst the leading resistant pathogen in the study. Confirming this high incidence of these organisms a study appraising the pathogen – E Coli, Klebsiclla Sp and Proteus Sp – at the UBTH by Obasaiki – Ebor *et al.* 1985 implicated those organisms in most cases of Urinary tract infections.
Pseudomonas aeruginosa, the Gram negative organism most frequently associated with 10-20 percent of the nosocomial infection and cystic fibrosis and isolated from individual with neo-plastic diseases. This organisms exhibited low incidence during the study being the least pathogen – explained by the fact that its pathogenicity towards healthy individual is low only troublesome as an opportunistic pathogen is patients (Hugo *et al.* 1980).

**Streptococcus Species** – a Gram positive organism which is implicated in major disease of man. A low incidence of this pathogen was recorded in Benin City during the study, this could be due to the fact that most infection where it is usually implicated are rare in the area of study and are therefore not frequently presented. This was affirmed in the work of Obaseike – Ebor et *al.* 1987.. However, it was observed that the organism was resistant to tetracycline, septrin, and gentamicin with fewer resistant to ampicilin, chlorampehicol and Erythromycin – resistant strain. For Stept. Haemolytious, its sensitivity can remain for up to 40 years after exposure to the drug. Methicillin is a drug of choice (Whitesheed, 1973), Gentamicin is also sensitive.

**Neisseria gonorrhoeae** the etiologic agent of gonorrhoea is the most prevalent of the classical veneral diseases. The emergence of Penicillinase producing strains of N.

gonorrhoeae (PPNG) would in no distant time threaten the successful us eof Penicillin and ampicillin in treating the infection – this Obasaiki –Ebor etal in 1985 clearly demonstrated: - That 87% of the strain to be PPNG thereby supporting the increasing incidence of resistance of PPNG to Penicillines as a source of cross-infection to others and ultimately contributes to the hospital environmental reservoir of resistant bacteria traceable to conjugation type of resistance. This is illustrated by Plasmid to other unrelated and previously sensitive species. Generally, Obasaiki Ebor etal 1987 in a lading survey shows the inappropriate prescriptions were higher in government hospitals (39.4%) than private hospitals (26%) while appropriate prescriptions were higher in private hospitals (56%) than government hospitals (48.4%). Similarly, studies have shown that the prescribing of antibiotics is often irrational in American hospitals. (Robert, *et al.* 1972).

One wonders what becomes of Nigeria, this is conclusive to the case of inappropriate prescription being implicated as one of source of bacteria resistance and high results have been obtained as regards sensitivity to antibiotics in hospitals with rational antibiotic policy through imposing tight restriction in the administration of antibiotics. Methcillin, Nitrofurantoin has demonstrated a decline in Staphylococcal and other infection though some strains of Proteus Spp were usually resistant (Obasaiki –Ebor *et al.* 1983).

Finally a reduction in the usage of antibiotic has often been associated with corresponding reduction in the frequency of isolation of resistant strains. A necessity is therefore imposed to carry out occasional routine laboratory tests to determine antibiotics efficacy.

The study reveals in summary **Staph aureus** to be very prevalent and with multiple antibiotic resistance with high resistances to ampicillin, tetracycline nd septrin and fairly for chloramphenicol, erythromycin, and gentamicin. This is due to public over indulgence in ampicillin, tetracycline and septrin self-medication in minor infections and clinical conditions not requiring antibiotic medication leading to massive selection of multiple – antibiotic resistant strains. Physicians share a part of blame on account of their inappropriate antibiotic prescribing and abuse in Benin City. (Obasaiki Ebor *et al.* 1987).

Pseudomonas aeruginosa showed moderate prevalence due to the use of immunosuppressive therapy following organ transplant leading to systemic infection including Pneumonia despite the fact that it is ubiguitous. It is not necessarily pathogenic (Hugo W. B. etal 1983). All isolates are multiple resistant and difficult to treat in infections but never antibiotics (Caftroiaxone etc) are useful. It was noted during the study that hospitals do not often use sensitivity tests as these drugs will soon develop R-Plasmid resistant to the organism. The importance antibiotic selective pressure as a result of improper self-medication noted in gentamicin resistant pathogen is worthy of further examination as gentamicin is a broad spectrum antibiotic of parenteral administration whose continous misuse could select R-plasmids resistant to gentamicin (Obasaike Ebor *et al.* 1985).

**E-coli, Proteus Spp, Kelsiella Spp and PS** aeruginosa were multiple resistant to antibiotics ampicillin, tetracycline, septrin and chloramphenicol. This contribute to the prevalence of these parthogens as the populace continues to indulge in self medication without cure of their ailment and selecting the resistant strains which can be transferred to others. Previous study supports this (Rotimi etal 1984, Obasaike Ebor etal 1983). Streptococcus species is implicated in infections such as tonsillitis (sore throat) are more in hospitals but readily

managed by self medication and so do not go to laboratory records. The organism is highly resistant to tetracycline, septrin and gentamcin.

## 5. Conclusion and Recommendations

This work has in no doubt been an intensive study into the alarming situation of prevalence of pathogenic bacteria and the observed pattern of resistance in Benin City, it is evident from the findings that antibiotics like ampicillin, tetracycline, Cotrimaxazole, chloramphenicol are not longer effective agent in treatment infection in the area of study Benin City but methicillin, gentamicin, Nitrofurantoin can be used in infection as they exhibit high sensitivity.

It is inevitable to call for imposition of tight restriction on the administration of antibiotics valuable in human medicine in form of formulation of articulated antibiotic policies which strictly enforces national antibiotics use. Since national use of antibiotics will ensure proven efficacy and reduce possible future lose of presently effective agents against bacterial infections, so that the ability of micro organisms to acquire resistance could be reduced while pharmaceutical industry's capacity to discover, market, and conserve new effective antibiotics are ensured.

Aggressive campaign, enlightenment or rather education of the public through audio-visuals, seminars, advice, to ensure that correct use of antibiotics is obtained –training to all medical staff along this line is necessary. The use of the laboratory sensitivity tests and research to control resistant development cannot be over-emphasized. Finally, regular monitoring of antibiotics as guarantee to update and evacuate those where resistance has developed from the prescription drug or the pharmacy should constantly be carried out.

**Conflict of Interest:** We hereby make a declaration that there is no conflict of interest in this manuscript.

## References

Adler, P. W. (1978) Treatment and Reporting Criteria – Diagnostic, treatment, and reporting criteria for non specific genital infection in sexually transmitted disease clinics in England and Wales. *British Journal of Veneral Disease* 54, 428-432.

Akhigbe, I. D. (1987), A retrospective survey of the prevalence of pathogenic bacterial strains and their antibiotic resistance pattern in private hospital and diagnostic Laboratories in B/City – a dissertation for Bachelor of Pharmacy degree – the University of Benin.

Brown, M .R. W., (Ed Resistance of Pseudomonas aeruginosa. London: John Willey and Sons.

Commentary: (1979): Non-compliance: Does it Matter? *British Medical Journal* 6199 1168.

Eniojukan, J. P. & Thomas, W. O. A. (1989) Antibiotic therapy: a review. *Pharmacy World Journal*, ( 5), 130 – 140.

Hugbo, P. G. & Okonkwo, J. O. (1980) Susceptibility of human skin bacteria to antibiotics. Microbios letter 33, 71-73.

Hugo, W. B. & Russiel, A. D.(1980) Bacterial Resistance to antibiotics: Pharmaceutical Microbiology, 2nd Edition, Redwood Burn, Great Britain 179-199.

Iserhienrhien F. A. (1987) A retrospective Survey of the Prevalence of Pathogenic bacterial strains and their antibiotic resistance pattern in government hospitals in Benin City – A dissertation for the Bachelor of Pharmacy degree of the University of Benin.

Joklik, W. K. & Willett, H. P. (1976) Properties of Selected bacteria specie: Linsser Microbiology 16th Edition, 431-690. Appleton-Centurycrofts , New York.

Joklik, W. K. & Willett, H. P. (1976) Transmissible Drug Resistance: Linsser Microbiology 16th Edition Appleton – Century crofts New York p. 160-163, 222-224.

Moddy, M. , Greene W.H. , Schimpff S.C. , Young V. M.: & Wiernik P.H., (1973) Annals of internal medicine 79, 684.

Moore, W. L. (Jr.) 1974 NOSOCOMIAL infections: an overview: *American Journal of Hospital Pharmacy* 9, 832 – 833.

Navashin (1979) The antibiotic era is not over. Academy of medical service USSR Published in *Mediscope Medical Newspaper by Literamed Publications* (Nig.) No. 50, 8.

Neu, H.C. & Howrey S.P. (1975) Testing the physician's knowledge of antibiotic Usage: Self- assessment and learning via Video tape. *The New England Journal of Medicine* 25, 1291 – 1295.

Obaseiki- Ebor, E. E. (1985) Prevalence of Common R – Plasmid Types in Clinical isolates of E Coli, Klebsiella specie and proteus specie. *Nigeria Journal of Pharmaceutical Sciences* 16-24.

Obaseiki – Ebor, E. E. , Afonya T.C.A. & Oyaide S. M. (1985) comparative invitro activity of cetriaxone against clinical bacterial isolates in Nigeria Chemotherapy 31, 130 – 137.

Obaseiki – Ebor, E. E. , Akerele, J. O. & Ebea P.O. (1989). A Survey of antibiotic out-patient prescribing and antibiotic self-medication in Benin City. *Journal of anti-microbial chemotherapy* 20: 759 – 763.

Obaseiki – Ebor, E. E.,& Breeze, A. S. (1983) Transferable Nitrofurantoin resistance conferred by R-Plasmids in clinical isolates of Escherichia Coli. *The Journal of antimicrobial chemotherapy* 12, 459 – 467.

Obaseiki – Ebor, E. E., Oyaide, S. M., & Okpere, E.E.E., (1985). Incidence of Penicillinase producing Nisseria gonorrhoea (PPNG) Strains and susceptibility of gonococoeal isolates to antibiotics in Benin City, Nigeria Genitourinary medicine 61, 367 - 370.

Skye, R. B. & Matthew M. (1976). The B – laetamases of gram- negative bacteria and their role in resistance to B-Lactam antibiotics. *Journal of antimicrobial chemterapy* 2, 115 – 157.

Whitehead J. E. M. (1973) Changing patterns of some common pathogen. *British medical Journa*l 2, 224 – 228.

Wilson D. (1976). The story of Penicillin – Penicillin in perspective (1st Edition) Feber and Faber New York U.S.A. , 3 - 4.

World Health Organization Scientific Working Group on antimicrobial resistance (1983) Bulletin of the World Health Organization, 61, 423-433.