Screening

Screening

Screening involves the detection of disease in an asymptomatic population in order to improve outcomes by early diagnosis of cancer at a curable stage. It follows that a successful screening programme must achieve early diagnosis and that the disease in question has a better outcome when treated at an early stage. The criteria that must be fulfilled for the disease, screening test and the screening programme itself are given in Summary box 12.2 . Merely to prove that screening picks up disease at an early stage, and that the outcome is better for patients with screen-detected disease than for those who present with symp - toms, is an insu ffi cient criterion for the success of a screening programme. This is because of potential inherent biases of - screening (lead time bias, selection bias and length bias), which make screen-detected disease appear to be associated with better outcomes than symptomatic disease. Summary box 12.2 Criteria for screening (based on Wilson–Junger criteria for a screening programme) /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF Lead time bias describes the phenomenon whereby early detec tion of a disease will always prolong survival from the time of diagnosis when compared with disease picked up at a later stage in its development whether or not detection in the screening pr ocess has altered the progression of the cancer (Figure 12.4 Selection bias describes the finding that individuals who accept an invitation for screening are, in general, healthier than those James Maxwell Glover Wilson , 1913-2006, Principal Medical O ffi cer at the Ministry of Health in London, England. Gunnar Jungner , 1914–1982, Chief Clinical Chemistry , Sahlgrenska Hospital, Gothenburg, Sweden. who do not. It follows that individuals with screen-detected disease will tend to live longer, independently of the condition for which screening is being performed. Length bias occurs because small, slow-growing tumours are likely to be picked up by screening whereas larger, fast-growing tumours are likely to arise and produce symptoms in between screening rounds. Screen-detected tumours will therefore tend to be less aggres - sive than symptomatic tumours. Because of these biases it is essential to carry out population-based randomised controlled trials and to compare the mortality rate in a whole population o ff ered screening (including those who refuse to be screened and those who develop cancer after a nega tive test) with the mortality rate in a population that has not been o ff ered screen - ing. This research design has been applied to both breast cancer and colorectal cancer: in both cases there was a reduction in disease-specific mortality . However, in general, clinical trials of screening with the gold-standard endpoint of overall survival have not been undertaken because of the very large number of participants required with long study follow-up periods. - Cancer screening remains a controversial topic with advo - cates on both sides of the argument. Targeted, risk-based screening approaches, such as computed tomography (CT) scan-based screening of smokers and ex-smokers for lung can -). cer, are being ev aluated as methods of developing more con - clusive screening programmes.

Prevention, Screening, Diagnosis, Staging, Treatment, Follow-up, Rehabilitation, Palliation Individual (primary care) Within this space we can Family categorise all aspects of (primary cancer management: from care) an individual person’s Community decision to give up smoking (local to the World Health hospital) Organization’s decision to recommend morphine rather Region than radiotherapy to treat (tertiary cancer-related pain in centre) resource-poor countries Country (national healthcare

system) Continent World (WHO) Figure 12.3 The management of cancer spans the natural history of the disease and all humankind, from the individual to the population of the world. The disease: Recognisable early stage Treatment at early stage more effective than at later stage Suf /f_i ciently common to warrant screening The test: Sensitive and speci /f_i c Acceptable to the screened population Safe Inexpensive The programme: Adequate diagnostic facilities for those with a positive test High-

quality treatment for screen-detected disease to minimise morbidity and mortality Screening repeated at intervals if disease of insidious onset Bene /f_i t must outweigh physical and psychological harm Fatal B Clinically detectable C Detected by screening A Tumour size Tumour a Tumour b x y 0 1 2 3 4 5 6 7 8 9 10 Time (y) Figure 12.4 An illustration of lead time and length bias. Tumour a is a steadily growing tumour; its progress is unin /f_l uenced by any treatment. Point A indicates the time at which

the tumour would be diagnosed in a screening programme, and point B indicates the time at which the tumour would be diagnosed clinically, i.e. in the absence of any screening programme. If the date of diagnosis is used as the start time for measuring survival, then, in the absence of any effect from treatment, the screening programme will, artefactually, add to the survival time. The amount of ‘increased’ survival is equal to y – x years, in this example just over 2 years. This artefactual in /f_l ation of survival time is referred to as

lead time bias. Tumour b is a rapidly growing tumour; again its progress is unin /f_l uenced by treatment. It grows so rapidly that, in the interval between two screening tests, it can cross both the threshold for detectability by screening and that of clinical detectability (at point C). It will continue to progress rapidly after diag

nosis and the measured survival time will be short. This phenomenon, whereby those tumours that are ‘missed’ by the screening programme are associated with decreased survival, is called length time bias.

Accurate diagnosis is the key to successful management of cancer. Precise diagnosis is crucial to the choice of correct therapy; the wrong operation, no matter how well performed, is useless. An unequivocal diagnosis is also the key to an accurate prognosis. Only rarely can a diagnosis of cancer be confidently made in the absence of tissue for pathological or cytological examination. Cancer is a disease of cells and, for accurate diagnosis, the abnormal cells need to be obtained and visualised by a histopathologist. Di ff erent tumours are classified in di ff erent ways: most squamous epithelial tumours are classed as well (G1), moderate (G2) or poorly (G3) di ff er entiated. Adenocarcinomas are also often classified as G1, G2 or G3 but prostate cancer is an exception, with widespread use of the Gleason system. The Gleason system grades prostate cancer according to the degree of di ff erentia tion of the two most prevalent architectural patterns. The

final score is the sum of the two grades and can vary from 6 (3 /uni00A0 + /uni00A0 3) to 10 (5 /uni00A0 + /uni00A0 5) with the higher scores indicating poorer prognosis. The ongoing development of molecular classifiers in many cancer types is beginning to profoundly alter our approach to treatment of these malignancies based on genetic mutations and other molecular fea tures identified in individual patients, i.e. in melanoma where patients with BRAF gene mutations can be successfully treated with the BRAF inhibitors. Molecu lar characterisation of malignancies and identification of their vulnerabilities have already become standard of care in many Donald F Gleason , 1920–2008, pathologist, The University of Minnesota, Minneapolis, MN, USA. likely to expand.

TABLE 12.3 Staging of colorectal cancer. TNM TX, Primary tumour cannot be assessed T0, No evidence of primary tumour Tis, Carcinoma in situ or intramucosal carcinoma T1, Tumour invades submucosa T2, Tumour invades muscularis propria T3, The tumour has grown through the muscularis propria and into the subserosa, which is a thin layer of connective tissue beneath the outer layer of some parts of the large intestine, or it has grown into tissues surrounding the colon or rectum T4, Tumour directly invades beyond bowel NX, Regional lymph nodes cannot be assessed N0, No metastases in regional nodes N1a, Metastases in 1 regional lymph node N1b, Metastases in 2 or 3 r egional lymph nodes N1c, There are nodules made up of tumour cells found in the structures near the colon that do not appear to be lymph nodes N2a, Metastases in 4–6 regional lymph nodes N2a, Metastases in ≥ 7 regional lymph nodes MX, Not possible to assess the presence of distant metastases M0, No distant metastases M1a, The cancer has spread to 1 other part of the body beyond the colon or rectum M1b, The cancer has spread to more than 1 part of the body other than the colon or rectum M1c, The cancer has spread to the peritoneal surface

Screening

Screening involves the detection of disease in an asymptomatic population in order to improve outcomes by early diagnosis of cancer at a curable stage. It follows that a successful screening programme must achieve early diagnosis and that the disease in question has a better outcome when treated at an early stage. The criteria that must be fulfilled for the disease, screening test and the screening programme itself are given in Summary box 12.2 . Merely to prove that screening picks up disease at an early stage, and that the outcome is better for patients with screen-detected disease than for those who present with symp - toms, is an insu ffi cient criterion for the success of a screening programme. This is because of potential inherent biases of - screening (lead time bias, selection bias and length bias), which make screen-detected disease appear to be associated with better outcomes than symptomatic disease. Summary box 12.2 Criteria for screening (based on Wilson–Junger criteria for a screening programme) /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF Lead time bias describes the phenomenon whereby early detec tion of a disease will always prolong survival from the time of diagnosis when compared with disease picked up at a later stage in its development whether or not detection in the screening pr ocess has altered the progression of the cancer (Figure 12.4 Selection bias describes the finding that individuals who accept an invitation for screening are, in general, healthier than those James Maxwell Glover Wilson , 1913-2006, Principal Medical O ffi cer at the Ministry of Health in London, England. Gunnar Jungner , 1914–1982, Chief Clinical Chemistry , Sahlgrenska Hospital, Gothenburg, Sweden. who do not. It

follows that individuals with screen-detected disease will tend to live longer, independently of the condition for which screening is being performed. Length bias occurs because small, slow-growing tumours are likely to be picked up by screening whereas larger, fast-growing tumours are likely to arise and produce symptoms in between screening rounds. Screen-detected tumours will therefore tend to be less aggres - sive than symptomatic tumours. Because of these biases it is essential to carry out population-based randomised controlled trials and to compare the mortality rate in a whole population o ff ered screening (including those who refuse to be screened and those who develop cancer after a nega tive test) with the mortality rate in a population that has not been o ff ered screen - ing. This research design has been applied to both breast cancer and colorectal cancer: in both cases there was a reduction in disease-specific mortality . However, in general, clinical trials of screening with the gold-standard endpoint of overall survival have not been undertaken because of the very large number of participants required with long study follow-up periods. - Cancer screening remains a controversial topic with advo - cates on both sides of the argument. Targeted, risk-based screening approaches, such as computed tomography (CT) scan-based screening of smokers and ex-smokers for lung can -). cer, are being ev aluated as methods of developing more con - clusive screening programmes.

Prevention, Screening, Diagnosis, Staging, Treatment, Follow-up, Rehabilitation, Palliation Individual (primary care) Within this space we can Family categorise all aspects of (primary cancer management: from care) an individual person’s Community decision to give up smoking (local to the World Health hospital)

Organization’s decision to recommend morphine rather Region than radiotherapy to treat (tertiary cancer-related pain in centre) resource-poor countries Country (national healthcare system) Continent World (WHO) Figure 12.3 The management of cancer spans the natural history of the disease and all humankind, from the individual to the population of the world. The disease: Recognisable early stage Treatment at early stage more effective than at later stage Suf /f_i ciently common to warrant

screening The test: Sensitive and speci /f_i c Acceptable to the screened population Safe Inexpensive The programme: Adequate diagnostic facilities for those with a positive test High-quality treatment for screen-detected disease to minimise morbidity and mortality Screening repeated at intervals if disease of insidious onset Bene /f_i t must outweigh physical and psychological harm Fatal B Clinically detectable C Detected by screening A Tumour size Tumour a Tumour b x y 0 1 2 3 4 5 6 7 8 9

10 Time (y) Figure 12.4 An illustration of lead time and length bias. Tumour a is a steadily growing tumour; its progress is unin /f_l uenced by any treatment. Point A indicates the time at which the tumour would be diagnosed in a screening programme, and point B indicates the time at which the tumour would be diagnosed clinically, i.e. in the absence of any screening programme. If the date of diagnosis is used as the start time for measuring survival, then, in the absence of any effect from treatment, the screening

programme will, artefactually, add to the survival time. The amount of ‘increased’ survival is equal to y – x years, in this example just over 2 years. This artefactual in /f_l ation of survival time is referred to as lead time bias. Tumour b is a rapidly growing tumour; again its progress is unin /f_l uenced by treatment. It grows so rapidly that, in the interval between two screening tests, it can cross both the threshold for detectability by screening and that of clinical detectability (at point C). It will continue to progress rapidly after

diag

nosis and the measured survival time will be short. This phenomenon, whereby those tumours that are ‘missed’ by the screening programme are associated with decreased survival, is called length time bias.

Accurate diagnosis is the key to successful management of cancer. Precise diagnosis is crucial to the choice of correct therapy; the wrong operation, no matter how well performed, is useless. An unequivocal diagnosis is also the key to an accurate prognosis. Only rarely can a diagnosis of cancer be confidently made in the absence of tissue for pathological or cytological examination. Cancer is a disease of cells and, for accurate diagnosis, the abnormal cells need to be obtained and visualised by a histopathologist. Di ff erent tumours are classified in di ff erent ways: most squamous epithelial tumours are classed as well (G1), moderate (G2) or poorly (G3) di ff er entiated. Adenocarcinomas are also often classified as G1, G2 or G3 but prostate cancer is an exception, with widespread use of the Gleason system. The Gleason system grades prostate cancer according to the degree of di ff erentia tion of the two most prevalent architectural patterns. The final score is the sum of the two grades and can vary from 6 (3 /uni00A0 + /uni00A0 3) to 10 (5 /uni00A0 + /uni00A0 5) with the higher scores indicating poorer prognosis. The ongoing development of molecular classifiers in many cancer types is beginning to profoundly alter our approach to treatment of these malignancies based on genetic mutations and other molecular fea tures identified in individual patients, i.e. in melanoma where patients with BRAF gene mutations can be successfully treated with the BRAF inhibitors. Molecu lar characterisation of malignancies and identification of their vulnerabilities have already become standard of care in many Donald F Gleason , 1920–2008, pathologist, The University of Minnesota, Minneapolis, MN, USA. likely to expand.

TABLE 12.3 Staging of colorectal cancer. TNM TX, Primary tumour cannot be assessed T0, No evidence of primary tumour Tis, Carcinoma in situ or intramucosal carcinoma T1, Tumour invades submucosa T2, Tumour invades muscularis propria T3, The tumour has grown through the muscularis propria and into the subserosa, which is a thin layer of connective tissue beneath the outer layer of some parts of the large intestine, or it has grown into tissues surrounding the colon or rectum T4, Tumour directly invades beyond bowel NX, Regional lymph nodes cannot be assessed N0, No metastases in regional nodes N1a, Metastases in 1 regional lymph node N1b, Metastases in 2 or 3 r egional lymph nodes N1c, There are nodules made up of tumour cells found in the structures near the colon that do not appear to be lymph nodes N2a, Metastases in 4–6 regional lymph nodes N2a, Metastases in ≥ 7 regional lymph nodes MX, Not possible to assess the presence of distant metastases M0, No distant metastases M1a, The cancer has spread to 1 other part of the body beyond the colon or rectum M1b, The cancer has spread to more than 1 part of the body other than the colon or rectum M1c, The cancer has spread to the peritoneal surface

Screening

Screening involves the detection of disease in an asymptomatic population in order to improve outcomes by early diagnosis of cancer at a curable stage. It follows that a successful screening

programme must achieve early diagnosis and that the disease in question has a better outcome when treated at an early stage. The criteria that must be fulfilled for the disease, screening test and the screening programme itself are given in Summary box 12.2 . Merely to prove that screening picks up disease at an early stage, and that the outcome is better for patients with screen-detected disease than for those who present with symp - toms, is an insu ffi cient criterion for the success of a screening programme. This is because of potential inherent biases of - screening (lead time bias, selection bias and length bias), which make screen-detected disease appear to be associated with better outcomes than symptomatic disease. Summary box 12.2 Criteria for screening (based on Wilson–Junger criteria for a screening programme) /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF Lead time bias describes the phenomenon whereby early detec tion of a disease will always prolong survival from the time of diagnosis when compared with disease picked up at a later stage in its development whether or not detection in the screening pr ocess has altered the progression of the cancer (Figure 12.4 Selection bias describes the finding that individuals who accept an invitation for screening are, in general, healthier than those James Maxwell Glover Wilson , 1913-2006, Principal Medical O ffi cer at the Ministry of Health in London, England. Gunnar Jungner , 1914–1982, Chief Clinical Chemistry , Sahlgrenska Hospital, Gothenburg, Sweden. who do not. It follows that individuals with screen-detected disease will tend to live longer, independently of the condition for which screening is being performed. Length bias occurs because small, slow-growing tumours are likely to be picked up by screening whereas larger, fast-growing tumours are likely to arise and produce symptoms in between screening rounds. Screen-detected tumours will therefore tend to be less aggres - sive than symptomatic tumours. Because of these biases it is essential to carry out population-based randomised controlled trials and to compare the mortality rate in a whole population o ff ered screening (including those who refuse to be screened and those who develop cancer after a nega tive test) with the mortality rate in a population that has not been o ff ered screen - ing. This research design has been applied to both breast cancer and colorectal cancer: in both cases there was a reduction in disease-specific mortality . However, in general, clinical trials of screening with the gold-standard endpoint of overall survival have not been undertaken because of the very large number of participants required with long study follow-up periods. - Cancer screening remains a controversial topic with advo - cates on both sides of the argument. Targeted, risk-based screening approaches, such as computed tomography (CT) scan-based screening of smokers and ex-smokers for lung can -). cer, are being ev aluated as methods of developing more con - clusive screening programmes.

Prevention, Screening, Diagnosis, Staging, Treatment, Follow-up, Rehabilitation, Palliation Individual (primary care) Within this space

we can Family categorise all aspects of (primary cancer management: from care) an individual person’s Community decision to give up smoking (local to the World Health hospital) Organization’s decision to recommend morphine rather Region than radiotherapy to treat (tertiary cancer-related pain in centre) resource-poor countries Country (national healthcare system) Continent World (WHO) Figure 12.3 The management of cancer spans the natural history of the disease and all humankind,

from the individual to the population of the world. The disease: Recognisable early stage Treatment at early stage more effective than at later stage Suf /f_i ciently common to warrant screening The test: Sensitive and speci /f_i c Acceptable to the screened population Safe Inexpensive The programme: Adequate diagnostic facilities for those with a positive test High-quality treatment for screen-detected disease to minimise morbidity and mortality Screening repeated at intervals if disease of

insidious onset Bene /f_i t must outweigh physical and psychological harm Fatal B Clinically detectable C Detected by screening A Tumour size Tumour a Tumour b x y 0 1 2 3 4 5 6 7 8 9 10 Time (y) Figure 12.4 An illustration of lead time and length bias. Tumour a is a steadily growing tumour; its progress is unin /f_l uenced by any treatment. Point A indicates the time at which the tumour would be diagnosed in a screening programme, and point B indicates the time at which the tumour would be diagnosed

clinically, i.e. in the absence of any screening programme. If the date of diagnosis is used as the start time for measuring survival, then, in the absence of any effect from treatment, the screening programme will, artefactually, add to the survival time. The amount of ‘increased’ survival is equal to y – x years, in this example just over 2 years. This artefactual in /f_l ation of survival time is referred to as lead time bias. Tumour b is a rapidly growing tumour; again its progress is unin /f_l uenced by treatment. It grows so rapidly that,

in the interval between two screening tests, it can cross both the threshold for detectability by screening and that of clinical detectability (at point C). It will continue to progress rapidly after diag

nosis and the measured survival time will be short. This phenomenon, whereby those tumours that are ‘missed’ by the screening programme are associated with decreased survival, is called length time bias.

Accurate diagnosis is the key to successful management of cancer. Precise diagnosis is crucial to the choice of correct therapy; the wrong operation, no matter how well performed, is useless. An unequivocal diagnosis is also the key to an accurate prognosis. Only rarely can a diagnosis of cancer be confidently made in the absence of tissue for pathological or cytological examination. Cancer is a disease of cells and, for accurate diagnosis, the abnormal cells need to be obtained and visualised by a histopathologist. Di ff erent tumours are classified in di ff erent ways: most squamous epithelial tumours are classed as well (G1), moderate (G2) or poorly (G3) di ff er entiated. Adenocarcinomas are also often classified as G1, G2 or G3 but prostate cancer is an exception, with widespread use of the Gleason system. The Gleason system grades prostate cancer according to the degree of di ff erentia tion of the two most prevalent architectural patterns. The final score is the sum of the two grades and can vary from 6 (3 /uni00A0 + /uni00A0 3) to 10 (5 /uni00A0 + /uni00A0 5) with the higher scores indicating poorer prognosis. The ongoing development of molecular classifiers in many cancer types is beginning to profoundly alter our approach to treatment of these malignancies based on genetic mutations and other molecular fea tures identified in individual patients, i.e. in melanoma where patients with BRAF gene mutations can be successfully treated with the BRAF inhibitors. Molecu lar characterisation of malignancies and identification of their vulnerabilities have already become standard of care in many Donald F Gleason , 1920–2008, pathologist, The University of Minnesota, Minneapolis, MN, USA. likely to expand.

TABLE 12.3 Staging of colorectal cancer. TNM TX, Primary tumour cannot be assessed T0, No evidence of primary tumour Tis, Carcinoma in situ or intramucosal carcinoma T1, Tumour invades

submucosa T2, Tumour invades muscularis propria T3, The tumour has grown through the muscularis propria and into the subserosa, which is a thin layer of connective tissue beneath the outer layer of some parts of the large intestine, or it has grown into tissues surrounding the colon or rectum T4, Tumour directly invades beyond bowel NX, Regional lymph nodes cannot be assessed N0, No metastases in regional nodes N1a, Metastases in 1 regional lymph node N1b, Metastases in 2 or 3 r egional lymph nodes N1c, There are nodules made up of tumour cells found in the structures near the colon that do not appear to be lymph nodes N2a, Metastases in 4–6 regional lymph nodes N2a, Metastases in ≥ 7 regional lymph nodes MX, Not possible to assess the presence of distant metastases M0, No distant metastases M1a, The cancer has spread to 1 other part of the body beyond the colon or rectum M1b, The cancer has spread to more than 1 part of the body other than the colon or rectum M1c, The cancer has spread to the peritoneal surface

---

Revision #1
Created 2025-12-31 15:08:39 UTC by Omar Ayman
Updated 2025-12-31 15:08:39 UTC by Omar Ayman